GAS JOURNAL

LIGHT ✂ HEAT ✂ POWER ✂ BYE-PRODUCTS

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VOL. CLXXXVII. No. 3457.] WEDNESDAY, AUGUST 21, 1929. [81ST YEAR.

Editorial Notes.

A Study in Phenols.

APART from our report of the meeting of the Irish Association, which is accompanied by many interesting photographs, and of the Irish Executive Board of the National Gas Council, our fare to-day is largely phenolic. We hasten to add, however, that the effect will be non-toxic; and we think that our readers will appreciate such a wealth of new information, in compact form, on the highly important question of effluents disposal.

Chief among the dishes is an excellently served account of the activities of the Emscher Commission, who have carried out their investigations in two directions—destruction of the phenols in effluent liquors, and elimination and subsequent recovery of the phenols in the course of the ammonia process. They discovered a destruction method which is technically sound but commercially unworkable; and consequently what we publish to-day—it is a translation in abstract of a paper by Dr. Max Prüss, Chairman of the Effluents Section of the Commission, presented at the recent meeting of the German Gas Association—is concerned with the second line of investigation.

Regarding this, perhaps greatest interest attaches to the work accomplished on the Pott-Hilgenstock process, which consists in washing the crude ammoniacal liquor with benzole, and recovering the phenols either by distillation or in combination with caustic soda. After preliminary tests the Commission bought up the patent rights of the process for the district controlled by the Ruhr waterway authorities, and erected four test plants. Working results of these confirmed the favourable opinion already formed, and provided proof of a 90 p.ct. phenol removal, which was sufficient to solve the Emscher effluents problem; and it was resolved, in collaboration with the coke ovens, to erect such plants wherever they could be operated successfully. It is intended to spend more than £100,000 on them in the next two years. The present market value of the phenolic product is about £10 per ton, and it is estimated that the costs of production for a coke works having a daily throughput of 1000 tons of coal would be £9 per ton, taking into account all costs except freight and selling expenses. Thus, it appears, the process will not be a financial burden. Also, viewed from the purification aspect, benzole washing, by removing from the ammoniacal liquor pyridines, neutral oils, and any traces of tar, in addition to the phenols, greatly reduces the harmfulness of the effluent, and renders it available for coke quenching if this be desired. A further advantage lies in the improvement effected in the quality of the ammonium sulphate.

Our article on the Koppers "hot-gas" process at the works of the Hamilton Coal and Iron Company—on which system Dr. Prüss has many comments—will also be read with interest. This phenol recovery plant is the first of its type to be operated on a full works scale. It was brought into use in April, 1928, and is treating 35,000 gallons of liquor per day. It consists of a steel tower 7 ft. in diameter and 95 ft. high, divided into four sections. In the top section the hot partially distilled ammonia liquor is dephenolized by counter-current passage of steam and inert gas, and the remaining three sections are caustic soda scrubbers. Among the claims made for the process are small ground space; a phenol removal efficiency of 95 p.ct.; high quality of the phenol recovered; and practically no extra labour required. Dr. Prüss states that the Emscher Commission were unable to adopt it owing to the higher capital cost as compared with the benzole process; and in any case the latter meets the local circumstances satisfactorily. Other conditions, he observes, can be imagined where such partial purification from phenols would not suffice.

Finally, as an addendum to the main articles, we publish an illustrated description by Mr. J. A. Shaw, of the Koppers Company, of an apparatus for rapid determination of phenols. By this method, which was developed in the Koppers Laboratory, the time required has been reduced from six to eight hours for the well-known Skirrow procedure to about thirty minutes.

Industry and the Universities.

SINCE the assertion of the National Fuel and Power Committee that the most economical use of fuel is largely dependent on a highly trained personnel, more attention has been paid to the subject of adequate training by all fuel producing or utilizing industries; and it is to be hoped that the outcome will be a closer and more effective bond between school and university in the first place, and between university and industry in the second. Taking a particular instance, only a few weeks ago we suggested that there was plenty of room for closer collaboration between individual gas concerns and the University of Leeds in a stronger attempt to provide, during vacation periods, facilities by which the student may add practical application to his theoretical knowledge. In other circles the same idea has been expressed, notably at a recent joint meeting of the Institution of Chemical Engineers and the Institute of Fuel, when a valuable discussion was opened by Dr. S. Wolff, and also in an address by Major F. A. Freeth to the Imperial College Chemical Society.

Opinions differ widely on what is or is not a desirable training, and the camps of practice and of theory still find supporters who do not greatly assist in a solution to the problem by an overdose of enthusiasm. It is exceedingly difficult to arrive at anything approaching an exact idea of what constitutes practice and what constitutes theory; but certain aspects of the collaboration problem appear to stand out like airship mooring masts. There is the unwarranted demand made by many hard-headed industrialists that the universities should turn out

graduates capable of tackling specialized situations which can be dealt with only by men of works experience; there is the failure of the university professors to be quite frank about the air of artificiality of academic training and research; there is the tendency of many students who resemble Strasbourg geese to assess their worth rather more highly than is justified by a cold market.

Regarding the first, much could be done if the industrialist offered better facilities for students during vacation periods. Such a plan requires money and considerable forbearance, because it is obvious that the temporary influx of students into works is not calculated to render the organization smoother or the temper of foremen and superintendents more patient and urbane—that is, of course, if the students are really given proper facilities to acquire first-hand practical experience, as distinct from mere observation. Coming to our second point—the atmosphere of artificiality in the universities—there can be no doubt that more insistence should be given to the development of faculties rather than the acquisition of information. This was emphasized by Sir William Larke during the discussion on Dr. Wolff's paper. He suggested that an academic training is a good foundation on which to build, provided such training is not of a character far too frequently given even in modern universities—producing little more than a highly developed gramophone record. As for the student, he might advisedly bear in mind that at college he is to a large extent in a pleasant and sheltered backwater of life, and that, even though he has acquired the status of industrial research worker, research "work of equal quality is "carried out about three or four times faster than it is "in academic circles," if only because "the workshops "and general mechanical facilities of the average univer- "sity will not compare with those of high-class industry." The remarks quoted are from the address by Major Freeth.

Thought on other phases of the problem of adequate and effective training only leads to the same conclusion—that many of the difficulties would disappear by closer co-operation, by greater sympathy between what are at present apt to be water-tight compartments, and by better education of parents and their children as to what careers may be opened up by a definite course of study. At the present time parents generally are prepared to sacrifice much for their children between the ages of fourteen and eighteen, to equip them socially; but social equipment in an economic age is in itself by no means sufficient, and perhaps a surer appreciation of the possibilities of longer and more evenly distributed education, both academic and practical, would yield more active spirits of greater worth to industry. Take our own industry, which is excellently served by the universities, particularly the University of Leeds, and which is comparatively far advanced in educational methods, can it be said that the possibilities which it offers for a career are uppermost in the minds of parents of the cultured classes? The possibilities are there, and they are growing; the trouble is that they are not known.

Minimizing Accidents.

Recognition of the importance of the human factor in the gas industry has had the inevitable effect of reducing the number of accidents, though, as with practically everything else, there is plenty of room for improvement. No safety campaign can achieve full success unless the interest of the employee in his work is maintained, for it is a well-known fact that the worker whose mind is preoccupied is a potential accident victim. The most direct way of preventing accidents lies in the proper selection of men; and such plans as that of the Wandsworth, Wimbledon, and Epsom District Gas Company, whose medical service scheme was outlined in the "Journal" a fortnight ago, are in the right direction. They are sound from the financial point of view; and, far more important, they provide proof of sympathetic consideration of the welfare of the workers. A man who likes his work, who is interested in his job and properly adapted to it, is less prone to accidents, because he is not an automaton.

We have before us the latest report of the American Gas Association Committee on Accident Prevention, and in this also the value of medical examination is emphasized. For example, proper selection of employees who are required to do heavy lifting would eliminate those who are predisposed to hernia—and incidentally it would have the double effect of lessening the risk of the non-lifter whose head might be in the way of a falling brick. Again, proper selection of motor drivers would be of value; and one of the recommendations of the report is that a careful record be maintained of all drivers to determine their individual susceptibility to accidents, and that at definite periods study be made to discover the underlying cause of failure. It may indicate impaired physical condition, or that the man is not fitted for the work. Competent supervision is a necessary corollary to proper selection; and in this connection the efficient maintenance of tools and materials is of great importance.

The most difficult part of the work is to ensure the continued interest of the men; and though discipline and its consequent control by fear is a medium to enforce interest in safety, it is not generally the most successful one, except in cases of extreme necessity and where circumstances warrant. However, the aim can be accomplished in many ways—by bonuses to the careful, by periodic talks on the subject, by first-aid classes, and so on. To indicate what can be done, no better example could be given than that afforded by the scheme, commenced thirty-seven years ago, of the South Metropolitan Gas Company. When an accident occurs, a jury of twelve workpeople calls and examines witnesses, visits the scene of the accident, and thoroughly investigates all the conditions and circumstances. With a view to preventing similar accidents, the members of the jury must endeavour to arrive at the real cause, and not hesitate to say whether any blame attached to any official or worker, or whether the plant, machinery, or means of protection were defective. They do so, as was explained recently in the "Journal" by Mr. A. Stokes, Joint Manager of the Company, knowing that no one will be penalized except in the case of wilful misconduct. The diminution in the number of accidents as a result of the working of the scheme has been remarkable.

Gas Mains in Subways.

The recommendation is made by Dr. F. J. Waldo, H.M. Senior Coroner for London, in his statutory report following upon his inquiry into the Victoria Embankment subway fire, that a public Government inquiry into the whole subway question should be held. Another recommendation is that the L.C.C. (Subway) Act, 1893, should be amended to remove the obligation to place gas mains in juxtaposition with electric cables in the subways owned by the London County Council; and Dr. Waldo maintains that the question of the inadvisability of associating gas mains and electric cables of any kind in a subway should be carefully considered. His view coincides with that of Mr. Doig Gibb, who recently stated that gas mains and electric cables would never live at peace in the same conduits. The further recommendations of Dr. Waldo, which will be found on a later page of to-day's "Journal," are concerned with the removal of all dormant cables from subways, with efficient lighting arrangements, and with reliable insulation.

The Growing Multiplicity of Conferences.

In 1926 the American Gas Association set up a Special Programme Committee to arrange what work should be carried out in the first three years and also the first five years; and Mr. George B. Cortelyou has recently reviewed the work which has been done. In the course of this, he mentions that the Commercial Section of the Association has now in full operation a course of training for domestic gas salesmen. Three hundred undertakings are subscribers, and nearly 3000 salesmen are participating. Of great value to the industry, he explains, is the issue of industrial data sheets which include information on about 200 installations. In concluding his review, Mr. Cortelyou calls attention to the growing multiplicity of conventions, conferences, and meetings of all kinds. It appears

that the conviction is gaining ground that the convention habit generally is being overdone, and that it is debatable whether in all cases the results justify the expenditure of time, effort, and money involved. "We may," he observes, "well look searchingly into our situation, to see whether there has been needless expansion in this direction."

Increase of Gas Sales in U.S.A.

During the first four months of this year 81 companies reporting to the statistical department of the American Gas Association enjoyed an increase of 12 p.ct. in gas sales. What is of greater importance than this bare statement, however, is that the percentage increase in consumers was 2·8, so that sales *per capita* have shown a splendid advance. The figures for May, which have just been published, are equally gratifying—an 11 p.ct. increase in gas sales and a growth of 2·5 p.ct. in the number of customers. The data in regard to gas produced and purchased for distribution by 96 companies for the first five months are significant: 6 p.ct. decrease in water gas production; 12 p.ct. decrease in coal gas production; 39 p.ct. increase in coke oven gas production; and 22 p.ct. increase in coke oven gas purchased from coke and steel companies operating bye-product coke oven plants.

Refrigerator Sales in New York.

In our issue to-day is an article outlining the sales methods of the Consolidated Gas Company of New York in building-up a substantial gas refrigeration load. The record of the Company is remarkable. They commenced selling gas refrigerators in 1927. In that year they sold 836, while in 1928 the figure was 5345. During the first four months of this year they sold 6174. It is pointed out in the article that the revenue from the sale of gas refrigerators in 1927 and 1928 was almost as much as that received from the sale of gas cookers, and that this year there is every likelihood that it will far exceed the amount received for cookers. There is, however, a far more important consideration than this. The Company have found that the extra consumption of the refrigerator—though admittedly small—has in many cases turned an unprofitable consumer into a profitable one.

A Question of Common-Sense.

One of the greatest present obstacles to progress, observed Prof. T. H. Pear, Professor of Psychology in the University of Manchester, in a paper entitled "The Human Factor in Industry," at the annual meeting of the Society of Chemical Industry last month, is the view that any improvement which can be effected by the application of industrial psychology is merely common-sense. This view, he said, is apt to be combined with the belief that, however untidy the next-door industry may be, one's own is not. It will readily be granted that many industries, in the nature of things, must be outwardly tidy. Minutely sub-divided work, for instance, has been tidied-up in advance, yet the processes of body and mind necessary to carry it out may be in a tidy or an untidy state, depending on the person. To the belief that common-sense is enough there should be added one or two disturbing doubts. First, whether one possesses in oneself all the common-sense available at present in civilized countries. Secondly, whether the common-sense of any expert is not what other people would call science. Thirdly, whether the study of an operation by a person who, though unacquainted with it, has been trained to observe many similar ones, does not often result in the seeing of similarities between them and the one in question. Fourthly, whether common-sense is not sometimes demonstrably wrong.

Square Pegs in Round Holes.

Prof. Pear has a strong objection to the phrase "square pegs in round holes." The purposes of vocational guidance and vocational selection, he maintains, are too complex and subtle even to be hinted at by such a geometrical expression. To describe jobs in general as "holes" is impolite, however true it may be of some. Moreover, many people have a fantastic and ruinous belief that work exists when it is not being done—as a hole exists even with no peg in it. This belief is costly to the community as well as to themselves. From the physiological and psychological point of view, a job is a series of events in some one person's body and mind. Exactly what those events are will depend on the worker. They are not likely to be identical in different workers; hence the objection to the description "square." And, except for jobs so simple that they are doomed to rapid supersession by machinery, there is no job which is not influenced by the worker's own peculiarities; hence the objection to the idea of the "hole" as having a fixed shape. The less we think of fixed pegs and fixed holes, the more likely we are to fit a worker to his work, and what is even more important, to fit the work, when possible, to the worker.

Gasholder Explosions.

Writing in the "A.G.A. Monthly," Mr. H. W. Alrich states that history provides a record of but three gasholders which have been wrecked by their own ignition and detonation. Other mishaps to holders which have been reported and spoken of as explosions were in fact structural failures, sometimes followed by a fire, but not by an explosion.

PERSONAL.

The Lieut.-Governor of the Isle of Man proposes to appoint a Commission to investigate the basis of taxation of motor vehicles, under the Highway Acts, with particular reference to the taxation of hackney carriages generally, and he has invited Mr. A. R. BISSET, Manager of the Douglas Gas Company, to serve on the proposed Commission. As the matter is one of great importance and some urgency, the Lieut.-Governor proposes to ask the Commission to report to him by Nov. 30 next, in order that the Commissioners' recommendations may be considered in time for the preparation of legislation for the ensuing legislative session.

Last Thursday, Mr. HENRY RULE retired from the position of Engineer and Manager to the Kelty Gas Company, Ltd., and Mr. DANIEL CAMPBELL is the new occupant of the post.

OBITUARY.

It is with regret that we have to record the death, at his residence, at Gwbert, Cardigan, on the 8th inst., of Mr. WILLIAM ST. DAVID GRIFFITH, brother of Mr. Arthur L. Griffith, the Secretary of the Society of British Gas Industries. The late Mr. Griffith, who practised as a civil and mining engineer, was well-known to many members of the Society, in which he always took great interest, and was very helpful to it in the early days.

The death has occurred of Mr. EDMUND LORD, Chairman of the Rossendale Union Gas Company. He occupied a seat on the Board of Directors for 40 years, for 22 years of which he held the position of Chairman.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Sept. 12.—NORTH BRITISH ASSOCIATION OF GAS MANAGERS.—Annual Meeting at St. Andrews.

Sept. 19.—SOCIETY OF BRITISH GAS INDUSTRIES.—Council meeting in the afternoon.

Sept. 19.—WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS.—General Meeting at Porthcawl.

Oct. 4.—MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.—General meeting.

Oct. 28-30.—BRITISH COMMERCIAL GAS ASSOCIATION.—Annual Conference at Eastbourne.

Engineering Index for 1928.—With the publication of this work, in two volumes, by the American Society of Mechanical Engineers, the first encyclopedic bibliography of periodical engineering literature of last year is made available to engineers in all branches. A total of 1700 periodicals, including our own "JOURNAL," has been reviewed to ensure its completeness, and our readers, especially those who have need of a complete and comprehensive index to periodical technical literature, will be glad to know of the existence of this Index, which for more than forty-five years has been recognized as an authentic guide to technical publications.

GAS STOCK AND SHARE MARKET.

[For Stock and Share List, see later page.]

ON the re-assuring advices from America with regard to the rediscount rate, the stock markets opened the new account in a more promising fashion. There was a decided improvement in the volume of business, and prices of the leading Home Government stocks showed substantial gains. Most of the leaders, however, became more subdued towards the end of the week, but Victory Bonds, influenced possibly by the dividend proximity, remained strong throughout.

In the Industrial Market also a more cheerful tendency prevailed, and at one time there was an outburst of excitement over American favourites, the initiative as usual coming from the other side.

In the Gas Market, apart from a further rise of 10 points in Imperial Continental capital stock, prices were inclined to ease off, and it will be noticed that, other than *ex* div. reductions, there were several quotations marked down. Dealers are not plentifully supplied with stock, but there are several small parcels of cheap stock offering.

The following transactions were recorded during the week:

MONDAY.—Barnet 7 p.c. 114½, Bournemouth 5 p.c. 13⅛, 6 p.c. pref. 11, 11¼, 3 p.c. deb. 55, 4 p.c. deb. 74½, British 5 p.c. deb. 96¼, Cape Town 4½ p.c. deb. 72½, Commercial 95, Gas Light and Coke 18s. 6d., 18s. 9d., 18s. 10½d., 4 p.c. pref. 74¾, Imperial Continental 365, 370, 371, 371½, Newcastle 3½ p.c. 17s., 4 p.c. pref. 73½, Primitiva 34s., 35s., 35s. 3d., South Metropolitan 102. Supplementary prices, Associated Gas and Electric "A" $63, Gas Light and Coke 7⅛ p.c., Brentford Bonds 101, 101¾, Hartlepool 5 p.c. max. 82.

TUESDAY.—Bournemouth 5 p.c. 13¼, British 5 p.c. deb. 96⅜, Cape Town 4½ p.c. deb. 72½, Croydon max. div. 84½, European 15, 15½, 15⅝, 16¼, Gas Light and Coke 18s. 7½d., 18s. 9d., 18s. 10½d., 4 p.c. pref. 74, 3 p.c. deb. 57½, Imperial Continental 368, 370, 370½, 371, 372, 374, Primitiva 4 p.c. 1st deb. 94½, 95, South Metropolitan 6 p.c. pref. 107, South Suburban 5 p.c 104, 5 p.c. deb. 96. Supplementary prices, Associated Gas and Electric "A" $63, Croydon 5 p.c. deb. 93, Hartlepool 5 p.c. max. 82, South Suburban 7 p.c. deb. 99½.

WEDNESDAY.—Commercial 94⅜, Gas Light and Coke 18s. 6d., 18s. 9d., 18s. 10½d., 19s., 3 p.c. deb. 57½, Imperial Continental 370, 373, 375, Primitiva 34s., 34s. 6d., South Metropolitan 101, 102, South Suburban 5 p.c. deb. 97. Supplementary prices, Croydon 7 p.c. deb. 102½, North Middlesex 5 p.c. pref. 89½, Ventnor original 19.

THURSDAY.—Gas Light and Coke 18s. 6d., 18s. 7½d., 18s. 9d., 18s. 10½d., 19s., 3½ p.c. 61½, 4 p.c. pref. 73, 73⅜, 5 p.c. deb. 98⅜, Imperial Continental 377, 378, 379, 380, 381, 382, 383, 384, 385, South Metropolitan 101, 102.

FRIDAY.—Cape Town 9¼, Cardiff 98½, 99¼, European 15½, Gas Light and Coke 18s. 6d., 18s. 9d., 18s. 10½d., 4 p.c. pref. 74½, 74⅜, 3 p.c. deb. 56½, 57½, Hong Kong and China 14⅛, 14⅜, Imperial Continental 380, 383, 385½, 386½, 387, 388, Primitiva 33s. 9d., 35s., South Metropolitan 101¾, 102¼, South Suburban 5 p.c. deb. 96. Supplementary prices, Folkestone 90, Newport (Mon.) 5 p.c. 80.

Money was in plentiful supply at the week-end. Fresh advances were obtainable from 4 p.c. down to 3½ p.c., while old loans were generally renewed at the former rate. Discount rates were steady, business being largely confined to short-dated bills. Treasury Bills were allotted at an average of £5 9s. 6·26d. p.c., being about ⅜d. p.c. below the previous week's rate.

The feature of the Foreign Exchange Market was the sharp decline in the French rate, which closed at 123.83½. Other Continental rates were comparatively steady. German marks closed unaltered at 20.35⅜; Italian lire finished at 92.74; Spanish pesetas at 33.05; Dutch florins at 11.10⅛; and Belgas at 34.86⅞. The dollar exchange closed slightly higher at 4.84 3/16.

Silver was a little firmer at 24 5/16d. per oz., but Gold was unaltered at 84s. 11½d. per oz.

The Bank Rate is 5½ p.c., to which it was raised from 4½ p.c. on Feb. 7. The Bank's deposit rate is 3½ p.c., and the deposit rates of the Discount Houses are 3½ p.c. at call and 3¾ p.c. at notice.

CAPE TOWN GAS UNDERTAKING.

By WALTER T. DUNN, M.I.Mech.E.

One of the writer's first calls on his arrival at Cape Town on July 22 was at the Offices of the Cape Town and District Gas Light and Coke Company, 42, St. George's Street. They are situated in a much-frequented thoroughfare, not far removed from the world-renowned Adderley Street, which corresponds to the Regent Street of London and the Princes Street of Edinburgh.

The frontages of the Offices are well designed, and the capacious windows contain compellingly attractive exhibits illustrating the advantages of the use of gas. A lady demonstrator, who is experienced in all the departments of cooking by gas, gives periodical homely discourses on how to produce the best gastronomical results in the most economic manner.

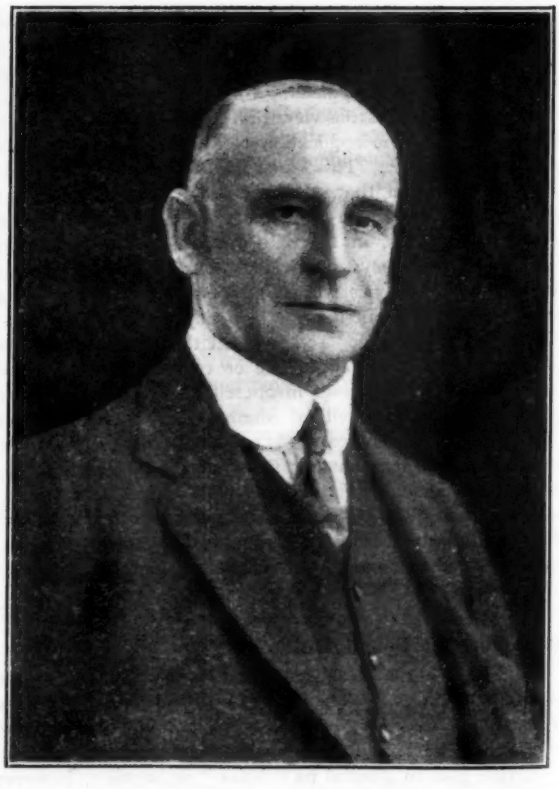
Inside the showrooms are shown the latest designs in gas water-heaters, irons, fires, cookers, and so on. The general impression of a visitor fresh from the Old Country was distinctly favourable.

The respective Engineers at Cape Town (Mr. H. N. Port), at Johannesburg (Mr. H. M. Tysoe), and at Port Elizabeth (Mr. Pennington Gardner) came from the county of Kent—Mr. Port from Tunbridge Wells; Mr. Tysoe from Milton Regis; and Mr. Gardner from Sittingbourne.

When Mr. Port entered upon his duties as Assistant Engineer at Cape Town twenty-four years ago (he was promoted to the position as Chief three years afterwards, in succession to Mr. Reilly) the undertaking was far from paying its way. To-day it is a concern paying 7 p.c. on its ordinary shares; its annual increase of make is a steady 8 p.c.; the accumulated arrears due to preference shareholders have all been paid off; and its future prospects are of the rosiest description.

The carbonizing plant at Woodstock consists of Glover-West verticals; the first battery of which, consisting of 16 retorts, making half-a-million c.ft. a day, were completed and brought into operation in July, 1914. In 1921 a further 24 retorts, capable of yielding 750,000 c.ft. a day, were erected. The question of reconstructing the settings to conform with the latest design in this type of installation is now under consideration. The need is pressing; and if the Engineer's recommendations are adopted, the effect will be an increase in the capacity of the plant by no less than 50 p.c. on the identical ground area, and the plant will be ready for utilization next January.

South African coal has been employed since the year 1912,



MR. H. N. PORT.

Engineer of the Cape Town Gas-Works.

brought from the Tendega mines in the district of Glencoe, Dundee. It costs at the pithead 5s. a ton; the transport charge (all rail borne) is £1 per ton. It contains 19 p.ct. of volatile matter, and 12 p.ct. of ash. The coke fetches £1 per ton on the works, and £2 per ton delivered at consumer's door. Bakers buy it, and the Government Railway Department is a good customer. The breeze, of which there is a considerable quantity, is quickly sold to brickmakers. Of tar, 30,000 gallons are obtained annually, but it is not used to any great extent for road making. The tar is distilled to 220° C.; the oil being used for the process of stripping old paint from the bodies of motor cars and other painted surfaces, preparatory to their being repainted.

The manufacture of sulphate of ammonia is out of the question, as there is such an adequate supply of guano fertilizer from the islands, where penguins abound.

There are about fifty men employed on the works.

To the Britisher the price of Cape Town gas (450 B.Th.U.)—viz., 10s. per 1000 c.ft.—will appear distinctly high; but when all the circumstances of the concern are taken into account, the charge is not excessive. During the war it went up to 11s. 8d. Then again, the figure of 16 p.ct. for unaccounted-for gas needs explanation. At one time it stood at 20 p.ct.; but when it is remembered that there are 140 miles of main laid in difficult places, and that the quantity unaccounted-for amounts to 200,000 c.ft. per mile of main, as against 300,000 c.ft. per mile in the Old Country, Mr. Port suggests that his figure is not discreditable, though he would like to better it.

There are four gasholders altogether; two at the works at Woodstock (100,000 c.ft. and 60,000 c.ft. respectively); one at Mowbray (500,000 c.ft. capacity); and one at Cape Town (120,000 c.ft.). The sides of the holders are used for advertising the merits of gas; and, as they can be seen from the harbour, they possess propaganda possibilities of value.

IRISH ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Dublin.

The Thirty-Seventh Annual Meeting of the Association was held in Jury's Hotel, College Green, Dublin, on Tuesday, Aug. 13, under the Presidency of Mr. L. W. DALBY, of Wicklow, who was faced by a large attendance of members when he delivered his address.

PRESIDENTIAL ADDRESS.

Mr. DALBY's address will be found in last week's issue of the "JOURNAL." At its conclusion,

Mr. T. N. WALSH (Navan) proposed a hearty vote of thanks to the President.

Mr. J. M'NICHOLL (Cork) said the members had had the pleasure of listening to a useful address. It was one that would very well repay discussion, were this permitted. Had an opinion as to the position of the gas industry in Ireland been asked of any member prior to the Address, it would probably have been found that the outlook of each one was pessimistic. They all knew certain undertakings which had been wiped out altogether, and others which had not recovered, or were not likely to recover, from the serious setbacks experienced during the troublous times. Now, however, their President had placed them under a deep debt of gratitude by giving them a broader view of the industry. It was very encouraging to learn that the outcome of the careful investigation carried out by Mr. Dalby had been to permit of an optimistic view of the future. It was now his pleasure to present to the President the medal which was his due on the expiration of his year of office. Mr. Dalby was quite a young man. At present he was in charge of a small works; but the stature of the man was very much greater than the size of his works, and in time, no doubt, they would find Mr. Dalby in a place better suited to his talents. When this time arrived, he hoped Mr. Dalby would look back with pleasure upon a happy year of office.

Mr. L. W. DALBY, of Wicklow,
Immediate Past-President of the Association.

The PRESIDENT, returning thanks, said he would be amply repaid if what he had said gave the members food for thought, even for a few minutes.

COMMITTEE'S REPORT AND ACCOUNTS.

The HON. SECRETARY AND TREASURER (Mr. George Airth, of Dundalk) then read the following report of the Committee:

COMMITTEE'S REPORT.

Your Committee have pleasure in reporting that our last Meeting in Belfast was a great success. The attendance was again a record. The papers read by Mr. Hyslop and Mr. Roberts were listened to with great attention. Those particularly interested in vertical retort working got food for thought and attention. Mr. Roberts' paper showed the way to combat electrical competition, and was a reminder to those who are about to enter into competition with the Free State Electrical Scheme to put their house in order, and be prepared.

It is with the most profound regret that your Committee have to report the death of two of our Past-Presidents. Thomas Frizelle was President on two occasions—in 1896, and again in 1908. J. E. Enright was President in 1916. Mr. Frizelle was a man of sterling worth, ever ready to give advice and to help-on any member who applied to him for assistance. He was present at our last conference. Mr. Enright, through failing health, had not been present for some years. To those who knew him, he had a charming manner and was a general favourite.

Your Committee would again bring before the members the diffidence of the members in coming forward to present papers. It is almost impossible—or it seems so by the results accomplished—to get members to put their thoughts on paper. It should not be necessary, year after year, to appeal, in the way we have, to get members to write papers.

The number of ballot papers sent in is 33. The number is again very small, and should be increased. Every member can send this in the same envelope as his subscription.

The balance to credit in the Treasurer's hands is £56 11s. 9d., compared with £32 17s. 7d. in 1927.

The AUDITOR (Mr. L. P. Phillips, of Dublin) presented the accounts, which he pointed out were very satisfactory—showing, as they did, that the Association were over £20 to the good as compared with the previous year.

On the motion of Mr. H. W. SAVILLE (Wexford), seconded by Mr. G. A. GILMORE (Warrenpoint), the report and accounts were unanimously adopted.

MEMBERS WHO HAVE PASSED AWAY.

The PRESIDENT asked the members to rise in respect to the memory of the late Mr. J. E. Enright and Mr. Thomas Frizelle.

DEVELOPMENT OF GAS SALES IN IRELAND.

Mr. W. H. AINSWORTH (Manchester) next read a paper on the "Development of Gas Sales in Ireland." This was followed by a discussion of outstanding interest to the members, which occupied practically the remainder of the session.

The paper, and a report of the discussion, are held over for the following issue of the "JOURNAL."

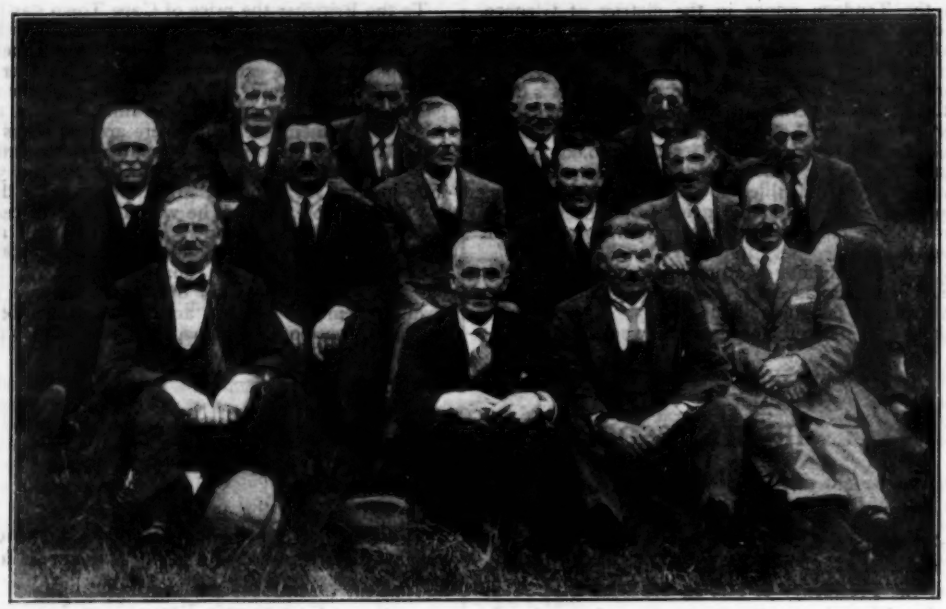
SCRUTINEERS.

The Scrutineers appointed to go through the ballot papers were Messrs. J. Oxley (London) and H. Saville (Leeds).

OFFICERS FOR 1929-30.

Subsequently the election was announced of the following officers for the ensuing twelve months:

President.—Mr. Wm. Buckley, Tralee.
Vice-President.—Mr. G. Walmsley, Londonderry.
Members of Committee.—Messrs. D. McIntyre, Dungannon; H. L. Adams, Tipperary; and L. G. Young, Carlow.
Auditor.—Mr. L. P. Phillips, Dublin.
Hon. Secretary and Treasurer.—Mr. G. Airth, Dundalk.



WITH THE NEW PRESIDENT, MR. WILLIAM BUCKLEY.

DISTRICT REPRESENTATIVE ON THE COUNCIL OF THE INSTITUTION.

Mr. SAVILLE proposed that Mr. Dalby should for the coming year be again elected District Representative on the Council of the Institution of Gas Engineers.

Mr. AIRTH seconded this, and it was agreed to.

PLACE OF NEXT MEETING.

Mr. AIRTH said he knew it was the wish of the incoming President (Mr. William Buckley, of Tralee) that the meeting next year should be held either at Tralee or Killarney; and unless the members were otherwise advised, they might take it that this would be done.

LUNCHEON.

This concluded the business meeting of the Association; and the members and their friends, on the invitation of the President, took light refreshments in the hotel.

NATIONAL GAS COUNCIL MEETING.

In the afternoon there was a busy meeting of the Irish District Executive Board of the National Gas Council of Great Britain and Ireland, at which there were addresses by Mr. E. J. Fottrell and Mr. W. M. Mason. The chair was occupied by Mr. Wm. J. Grey, Secretary and Accountant of the Alliance and Dublin Consumers' Gas Company; and the addresses were followed by a full discussion. A report of the meeting will be found on other pages of this issue of the "JOURNAL."

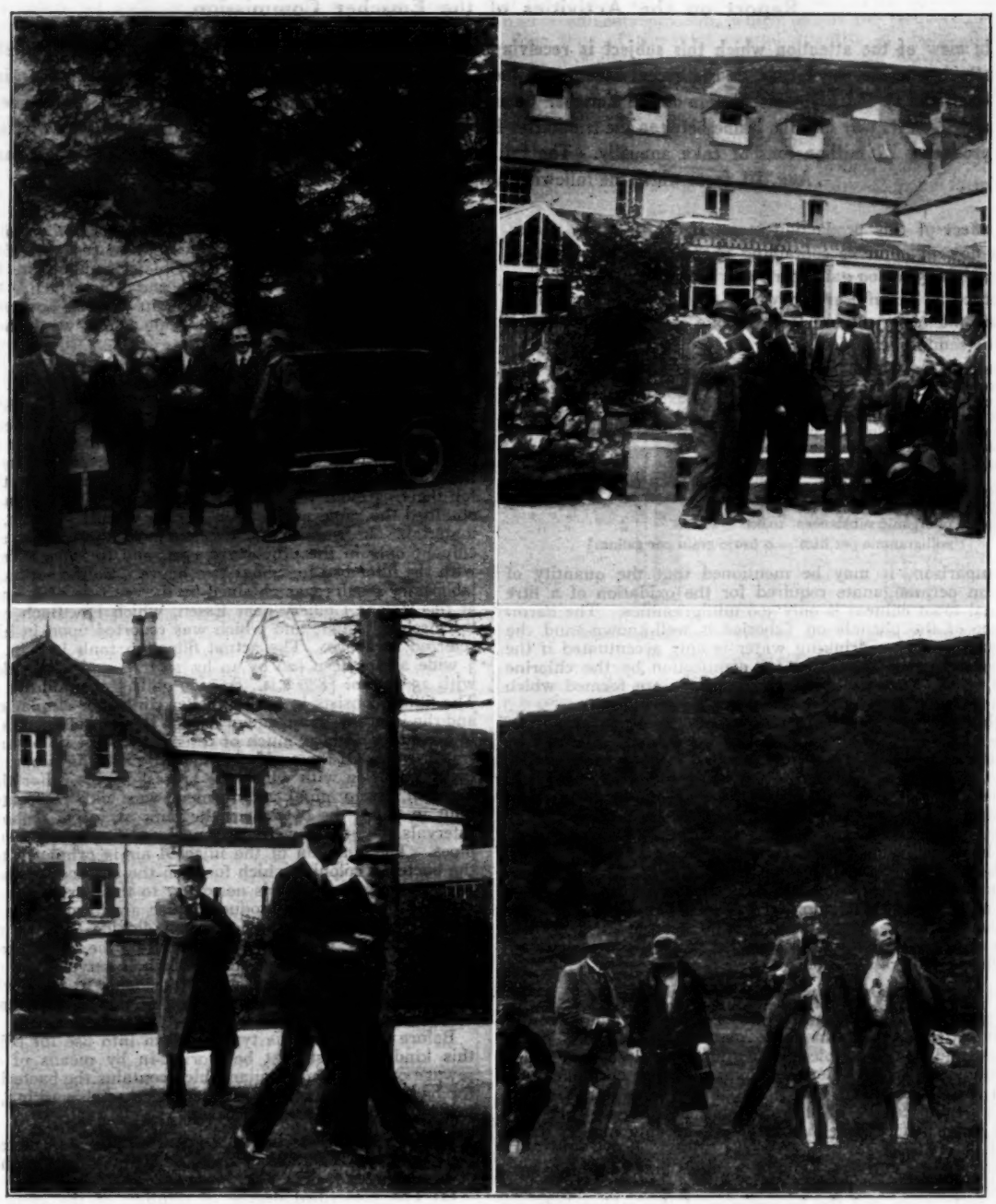
THE DINNER.

In the evening there was a large attendance of members and ladies at the annual dinner, which took place in Jury's Hotel, with the PRESIDENT in the chair. Some brief speeches were interspersed with song and story, well rendered by Mr. Bertie Irwin, Miss Phillips, Mr. Simmons, and Mr. Selfe. The evening was a complete success in every respect.

The PRESIDENT, on behalf of the Committee of the Association, extended a hearty welcome to the many guests present. Mr. J. M'NICHOLL, submitting "Our President," said his duties had been discharged with credit to himself and to the Association. In his reply, the PRESIDENT acknowledged the great help which he had received from Mr. Airth and the members of the Committee. The toast of "The Ladies" was drunk at the call of Col. GLOVER, and responded to by Mr. W. M. MASON. The remaining toast was "Kindred Associations," which was in the hands of Mr. T. J. REID, who remarked that the perfection of universal brotherhood would be hard to attain, but good feeling and co-operation in an industry like theirs was easier of accomplishment. They were a small Association; and there were other organizations which did a much larger work. He referred to the parent Institution of

THE IRISH ASSOCIATION AND FRIENDS AT GLENDALOUGH.

MORE PHOTOGRAPHS OF THE IRISH MEETING.



"UNOFFICIAL" SNAPSHOTS.

Gas Engineers, the National Gas Council, the British Commercial Gas Association, the North British Association of Gas Managers, &c. The first to respond was Mr. E. J. FOTTRELL, who pointed out that the number of Associations was growing by leaps and bounds. Since he last replied to the same toast a year ago, there had been formed a Creosote Association and a Pitch Association; and they were now in the act of bringing into being a body that would be known as the Tar Products Association. In connection with the toast, mention should be made of the Society of British Gas Industries, who were well represented there that evening. Mr. J. F. TYNDALL (Deal), replying on behalf of the Institution of Gas Engineers, said he was delighted to have had this opportunity of meeting again so many old friends. It was fifteen years since he was in Ireland, in the very works which the President now controlled. Mr. JOHN J. PATERSON (Dover), for the Southern Association, remarked that, like Mr. Tyndall, he was grateful for the opportunity of again meeting so many old friends. It was ten years since he left Ireland. Mr. JOHN RICHMOND (Penicuik) spoke for the North British Association and the Waverley Association, and said it was a great pleasure to come to Ireland year by year.

THE EXCURSION.

Wednesday was devoted to an excursion, in which a party of members and friends to the number of about a hundred joined, to the historical and beautiful neighbourhood of Glendaloch, where, favoured by ideal weather, an extremely enjoyable time was spent. Ireland lends itself well to delightful excursions of this character, and the Association have at one time or another visited various beauty spots; but many of those who took part expressed the opinion that none had been more full of pleasure than this year's outing. Of course, success on such occasions does not come of itself; and the participators realized fully to whom they were indebted for the organization which rendered possible a day like this. There was therefore enthusiastic support for the vote of thanks to Mr. George Airth, which was felicitously proposed by the President. The Royal Hotel, at Glendaloch, proved itself fully equal to the task imposed upon it of providing dinner and tea for the party, who journeyed by three motor buses; and in the interval the sites of the Seven Churches, the Round Tower, the relics of St. Kevin, and the glorious valley with its two lakes were the subjects of appreciative study.

EFFLUENTS AND THE PHENOL PROBLEM.

Report on the Activities of the Emscher Commission

In view of the attention which this subject is receiving in this country at the present time, particular interest attaches to the paper read at the recent meeting of the German Gas Association. Dr. Max Prüss, the author, is Chairman of the Effluents Section of the Emscher Commission, the authority controlling the river of that name, which, on its way into the Rhine between the tributaries Ruhr and Lippe, serves a district containing 75 coke works, producing 27 million tons of coke annually. The full text was published in "Das Gas- und Wasserfach" for Aug. 10, from which the following abstract translation has been prepared.

The effect of this production is estimated to mean a continuous flow of effluents containing phenols into the Emscher at the rate of 75 to 100 galls. per sec. The contents which may be regarded as harmful are shown by the following analysis of the ammonia plant effluent from a coke works in the district using the semi-direct process:

Phenols (estim. as C_6H_5OH) . .	1,300 to 2,700	milligrammes	per litre
Sulphocyanides (estim. as CNS) .	90 ,, 260	,,	,,
Total nitrogen excl. CN (as ammonia and organic nitrogen) .	160 ,, 350	,,	,,
Total sulphur (as sulphates and sulphides and organic combinations)	260 ,, 1,400	,,	,,
CaO	400 ,, 900	,,	,,
Quantity of $KMnO_4$ required according to Kubel-Tiemann for oxidation of organic substances	10,000 ,, 40,000	,,	,,

[1 milligramme per litre = 0·04076 grain per gallon.]

For comparison, it may be mentioned that the quantity of potassium permanganate required for the oxidation of a litre of normal town effluent is only 300 milligrammes. The harmful effect of the phenols on fisheries is well-known, and the unpleasant effect on drinking water is only accentuated if the latter is subsequently treated for disinfection by the chlorine process, since phenol-chlorine combinations are formed which give an unsavoury flavour, however great the dilution.

Judging by developments in recent years, there appears to be no likelihood of any basic alteration in coking processes by which this effluents difficulty may be wholly or partially solved; rather the contrary. At the present time there are being run into the Emscher some 10,000 tons yearly of phenol oils and kindred material, or about double the quantity which is being recovered and marketed in the whole country. As no arrangements have in the past been made by individual firms to deal with the trouble, this whole quantity, as well as the quota from other tributaries, has been reaching the Rhine in unchanged form, and considerable damage has resulted. The Emscher Commission, as a public body, has in recent times devoted serious attention to the matter, and the general conclusions are embodied in the present report.

The Direction of Investigation.

The experiments made may be divided into two main groups. At first, attempts were made to destroy the phenols in the effluents, and to this problem a solution was discovered which was technically sound, though commercially unworkable. Attention was then given to the possibility of eliminating the phenols in the course of the ammonia process, so that they should never reach the effluents at all, or only in very small quantities.

It was in England that effluent troubles first came into prominence, which can be readily understood when the small size of the waterways and the importance of the coking industry are taken into account. There it is customary to submit even the ordinary town sewage to complete purification before it reaches the waterway, and this of course can only be done by bacteriological processes. In the course of these it was observed that the presence of even considerable quantities of ammonia effluents had little or no detrimental effect, and that the phenols, which are, of course, organic matter, became mineralized along with the other organic substances in the household sewage. Recent tests in Germany have shown that up to 10 p.ct. of ammonia effluents do not seriously interfere with the bacteriological processes. Naturally in such estimates the ammonia effluent with its greater concentration must be compared with five or ten times its own bulk of the other.

As long ago as 1904 the English chemist Fowler succeeded in showing that the sulphocyanides as well as the phenols could be completely destroyed by bacteriological processes even without any continuous admixture of large quantities of household sewage. His method was to add at first very little, and then gradually more and more, of the phenols, and so to accustom the bacteria by degrees to what would normally be a poison to them. The normal sewage could not in any case be introduced to the bacteriological process without previous dilution with about nine times its own bulk of pure water, for which purpose Fowler used the purified outflow from the process. These experiments, which led to the erection of a large plant at Bradford, were further tried out by the Emscher Commission in their own test plant, and, for the detailed results, reference is made to their publication by the Chief Chemist, Dr. Bach, in Nos. 42, 43, and 44 of "Das Gas- und Wasserfach," October, 1926. The capital costs of the plant would, however, have rendered it impracticable on the scale which would be needed for the Emscher effluents.

The "Emscher" Filter.

In an attempt to reduce initial costs by an intensification of the activity of the biological media, Dr. Bach succeeded in laboratory apparatus in achieving considerably greater effect by artificial aeration than is possible with the simple aeration in the Fowler process. Against 180 cub.m. required by the latter for the treatment of 1 cub.m. of undiluted sewage a day, he obtained the same purification efficiency with 2 cub.m. of filter material. It was found necessary to dilute the ammonia effluent only in the proportion 1 : 4, and to leave it in contact with the filter bed for about two hours. Confirmation of these laboratory results was obtained by the erection of a small plant at the Helene Colliery near Essen, which Dr. Bach called the "Emscher" filter, and which was reported upon in his article referred to above. The actual filtration tank is 8 m. long by 3 wide and 3 deep [26 by 10 by 10 ft.], and it can deal daily with 25 cub.m. [880 c.ft., or 5500 galls.] of undiluted effluent. The filling consists in broken boiler clinker or similar material, and the internal arrangement is such that the effluent is brought into contact with as much of it as possible in its passage from end to end. Of the purified effluent, four-fifths is pumped back for the dilution with which the process begins. For the forced aeration, the original arrangement was with perforated tubes built in along the bottom of the tank at 30 cm. [about 1 ft.] intervals, but these were later replaced by movable suspended pipes. The function of the injected air is primarily to supply the bacterial colonies which form on the surfaces of the clinker with the oxygen which is necessary to their existence. It also serves to flush out the products which are formed as a result of the bacterial action—chiefly carbon dioxide—and so maintain the conditions which are suitable for the existence of the bacteria. Yet another purpose which it serves is to clear the small quantities of sludge which are liable to form within the clinker bed during the mineralizing of the phenols, and which would eventually clog it.

Before a filter of this type is taken into use for effluents of this kind, it must first be worked-in by means of domestic sewage or something similar which contains the bacteria needed for bacterial purification. For its successful working, the following conditions are also necessary:

(1) An effective stock of bacteria must be maintained by the constant addition of quite small quantities of household sewage.
(2) The prescribed degree of dilution of the effluent to be treated should be maintained as steadly as possible.
(3) The alkaline reaction of the effluent should remain as far as possible unchanged—that is to say, sudden and violent variations in the pH-value are to be avoided.
(4) The temperature should not vary beyond the limits 20° to 25° C.; particularly in summer some cooling of the effluent is necessary below the temperature at which it comes from the ammonia plant.
(5) Considerable aeration is imperative. At the Helene Colliery it was found necessary to use 60 cub.m. to every 1 cub.m. of effluent to be treated.

So long as these conditions are reasonably maintained, little other supervision is required, and, in comparison with others, the "Emscher" filter seems by no means sensitive. At times, serious variations were observed in the alkalinity of the effluent, due to faulty supervision in the ammonia plant, so that the pH-value varied between 8 and 11. On such occasions the efficiency of the bacterial process was seriously affected, but it was quickly restored when the alkalinity returned to normal. Even after a considerable stoppage of the plant, the efficiency was easily worked-up again.

Objections to the Process.

Though by this process considerable capital outlay is saved as compared with the Fowler process, and an efficient puri-

fication is achieved, yet the capital and working costs are still comparatively high for such a case as that of the total Emscher effluents. The chief item is the very great consumption of compressed air, which, as already stated, amounts to 60 cub.m. for every 1 cub.m. of undiluted effluent, even with the most careful management and best possible construction of the filter. The consumption of potassium permanganate for the purified effluent from the filter amounts to only 600 to 800 milligrammes per litre, against 10,000 to 40,000 for the effluent in an untreated state. The absolute content of phenols, sulphocyanides, and sulphur in the purified effluent is so small that it does not answer even to the most severe chemical reaction, and such effluent can, of course, be run into any reasonably flowing stream without the least fear of harm. It may here be mentioned that other modern bacteriological processes with forced aeration, in particular the activated sludge process in various forms, are likewise suitable for the treatment of phenol effluents, though they are liable to be more sensitive than the Emscher filter to variations in the composition of the effluents. Naturally also there are possible combinations of the two processes, just as in the case of household sewage, and experiments on these lines are now being conducted by the Rhine Commission in Essen. In any case, at least, where the running of phenol effluents into a sluggish stream has to be avoided whatever the cost, the "Emscher" filter provides a thoroughly reliable and practicable means.

Experiments on Other Lines.

As already stated, the magnitude of the Emscher problem put it out of court. The real water course of the district is the main stream of the Rhine, with a mean flow of 2000 cub.m. [440,000 galls.] per sec. In the first ten years of the present century, when the coke production was far below the current figure, there was no noticeable damage due to the effluents from the Emscher region. It may therefore be assumed that, with the natural dilution and breakdown of the phenols which would occur in any case, the Rhine could quite well take a large proportion of the total quantity without treatment, and that the problem of the Commission would be solved by dealing with a part only of the 10,000 tons. Attempts were therefore made simultaneously with the bacteriological experiments to find other less costly means of treatment. One line of investigation was to mix the ammonia effluents with the coke quenching water, with the idea that a large part of the phenols would be vaporized or dissociated during the quenching process. This was tried at several collieries, but had to be confined, of course, to cases where mechanical quenching towers were available, since with hand quenching the health of the workmen would be endangered by the fumes. But even with mechanical quenching the process is practicable only at considerable distances from dwellings and sensitive vegetation. It is consequently seldom that it can be used in Germany, though comparatively common in America. Still less is it practicable to dispose of the effluents by way of the subsoils, either by running them into disused workings or by other means, since eventually they are bound just the same to affect the water supply. Hopes were also entertained that a considerable diminution of the phenol contents might be effected by trickling the effluents over the pitheaps which are common enough in the district, but no confirmation of this was obtainable. The American practice was also tried of driving the phenols, after their release from the lime combination, into the air by means of a counter-stream of hot waste gases in a tower-scrubber. But this process had to be abandoned not only on account of the high working cost, but also because of the damage caused in the district by the descent upon it of the phenol vapours.

The "Pott-Hilgenstock" Process.

At this stage, the conclusion was definitely reached that the phenol problem, on the scale which faced the Emscher Commission, was not soluble, from the cost point of view, by any known method of treating the effluents in the state in which they were produced. Attention was consequently turned to discovering some means of avoiding or limiting their production in a condition so difficult to deal with. The question having thus become one affecting the actual working process of the coke-ovens, a committee was called from among prominent technical men in the industry. As a result of very thorough investigations, attention was attracted towards the end of 1922 to the process known as the Pott-Hilgenstock. This consists in treating the crude liquor, before driving off the ammonia, with a wash as little soluble in water as possible, and recovering the phenols from this wash either as a residue of distillation or combined with caustic soda—that is to say, as a marketable product.

After a few preliminary tests by the Lothringen Colliery at their own coke works, and by the Bamag Company at the Heinrichshütte ovens, the Commission decided to buy up the patent rights of the process for the district controlled by the Ruhr waterway authorities, and to erect four test plants, at the collieries Dorstfeld, Mathias Stinnes, and König Ludwig, and the Jacobi Drift. These plants were started up at the end of 1926, and their working has afforded proof that it is quite possible to recover up to 90 p.c. of the phenols from coke oven effluents, provided always that the degree of concentration of the phenol in the liquor does not fall below a certain point. By a large number of tests and calculations, it was also deduced that the process would be quite applicable to the solution of the Emscher effluents problem, which means the recovery of 5000 to 6000 tons of the total annual quantity of 10,000 tons of phenols produced. It was therefore resolved, in collaboration with the coke ovens, to erect such plants wherever they could be successfully operated, and it is intended to spend more than £100,000 on them in the next two years.

The Working of the Process.

The principle of the process is seen in figs. 1 and 2, the first of which shows how the phenols are recovered in the form of a

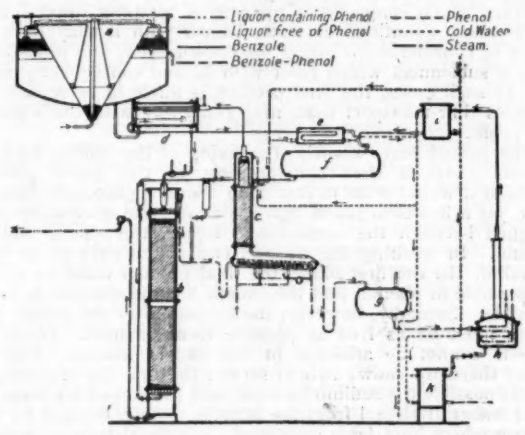


Fig. 1.—Phenol extraction by washing, and recovery of the phenols by distillation as crude phenol.

a Container with preliminary cleaner	*f* Benzole storage
b Washer	*g* Phenol storage
c Distillation plant	*h* Distillation
d Heat exchanger	*i* Benzole condenser
e Condenser	*k* Phenol condenser

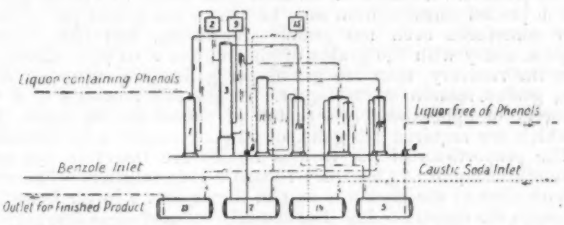


Fig. 2.—Phenol extraction by washing, with caustic soda method of phenol recovery.

crude phenol oil by distillation of the wash fluid. The ammoniacal liquor, before treatment in the ammonia plant, is washed on the counterflow principle with a solvent which is insoluble in water, for instance benzole. This absorbs the phenols from the liquor, and from the benzole-phenol mixture the benzole is vaporized, to be subsequently re-condensed and used again. An important characteristic of the treatment is that it takes place prior to the ammonia process, so that any traces of benzole which are carried by the liquor in solution or emulsion beyond the phenol plant are vaporized in the ammonia stills, and do not reach the river. The residue from the phenol plant is a phenol oil with tarry impurities, containing about 75 p.ct. of phenol. It contains also traces of benzole and a small quantity of pyridine bases, and it is a readily saleable product. Its value depends mainly upon the proportion in which carbolic acid and cresols are contained in the phenol portion. In the most favourable circumstances this proportion is 1 : 1. At the worst, the carbolic acid amounts to only half the quantity of the cresols.

It was assumed at first that it would take comparatively small quantities of the solvent to effect the required 80 to 90 p.ct. solution, since benzole is capable of dissolving considerable quantities of phenol. But it was found that, even at a temperature of 50° to 60° C., it was necessary to use a quantity of benzole equal to about 50 p.ct. of the liquor to be washed. This meant a considerable increase in the cost of the distillation part of the process. On an average, the litre of benzole absorbed only 10 to 15 grammes of phenol, so that the recovery of 1 kilo. of phenol meant the vaporization of 99 litres of benzole [about 825 galls. per lb.]. The cost of the necessary steam in this process amounted to more than one-half of the total costs, and, after extensive tests, it was decided instead to

extract the phenol from the phenol-benzole mixture by washing with caustic soda.

THE CAUSTIC SODA PROCESS.

This process is shown in fig. 2. A similar solvent, such as benzole, is again used, and the mixture is passed into another washer, where it is treated with caustic soda, with which the phenols react. This leaves the benzole to be returned to the process, while the residue is a saleable product. The latter is improved in quality if the liquor, before being washed with benzole, is freed as far as possible of tarry and oily impurities. This preliminary purification can be conveniently effected by passing the liquor first through a standing column of benzole, which absorbs such impurities, and must, of course, be replaced or regenerated when necessary. It is also very important to separate thoroughly from water the benzole-phenol mixture which comes from the phenol washing tower. Even quite small quantities of water mixed with it may have the effect of considerably diluting the caustic soda, and introducing into it substances which react with it, and consequently waste it. In such cases, the final product is liable to be so weak in phenols that transport costs may run away with the whole of the profit.

The second part—namely, the fixing of the phenol with the caustic soda—is the chief problem of the whole process. Though it would seem to rest upon a simple chemical combination, yet it has been found that a kind of state of equilibrium is reached between the ammoniacal liquor, the alkali, and the phenol. In working the washer, two points have to be borne in mind. In the first place, the final product must be as rich as possible in phenol, and the caustic soda exhausted as far as possible. Secondly, however, the benzole after the caustic soda wash must be as free as possible from phenols. These two objects cannot be achieved in one simple washer. The diagram therefore shows two in series; the first for enriching as far as possible the sodium hydrate, and the second for removing final traces of phenol from the benzole. Many designs for suitable washers have been submitted, into the details of which it is impossible to enter here. But some interesting figures may be given as to the working and the economics of the process.

SOME FIGURES.

Taking a fairly large coke works with a daily throughput of 1000 tons of coal, the quantity of liquor containing phenol will vary between 39,000 and 66,000 galls., according to the bye-product processes employed. With modern very high-temperature processes it may even amount to as much as 110,000 galls. The phenol concentration may be 280 to 140 grains per gallon, or sometimes even 100 grains. Assuming, therefore, 66,000 galls. a day with 140 grains of phenol, and a 90 p.ct. efficiency in the recovery, then 126 grains per gallon are extracted, and 14 grains remain in the liquor. In all, this amounts to a recovery of approximately 0·54 ton of phenol per 24 hours, for which are required 440 galls. of 20 p.ct. caustic soda solution. The proportions of the various liquids are therefore 150 ammoniacal liquor: 75 benzole: 1 caustic soda solution. The concentration of the phenol is as 1 in the liquor: 2 in the benzole: 140 in the caustic soda. Particularly interesting is the proportion between enriched wash and caustic soda—viz., 75: 1, which means that there is only one part of caustic soda solution for 75 parts of benzole, and that, consequently, very efficient apparatus is required.

As to the profit estimate for such a plant recovering approximately half-a-ton of phenol in 24 hours from 66,000 galls. of liquor, capital costs may be put at a total of £50,000, upon which interest and depreciation at 20 p.ct. amount to about 55s. a day. Other daily costs are estimated at 8s. for upkeep; 10s. for wages; 87s. for cost of wash, caustic soda, and other materials; and general 20s., making a total of £9. The present market value of the product is about £10, leaving a surplus of £1 to cover freight and selling expenses. The market for phenols is so variable that an estimate for any distance ahead can only be very approximate, but in any case the process must be regarded as having for its object the purification of effluents, and not the making of a profit.

Regarded from the purification point of view, it has proved an undoubted success. By washing with benzole, not only is the phenol removed, but also pyridines, neutral oils, and remaining traces of tar, so that the harmfulness of the effluent may be said to be reduced to only one-third or one-quarter of the normal. At the same time, the effluent is made available, if required, for certain works uses, such as coke quenching. Another gain is that, owing to the intensive washing to which the liquor is subjected before the ammonia recovery process, the ammonia plant is far less affected by oily and tarry fouling, cleaning-out is reduced, and steam consumption economized. The quality of ammonia salt produced is considerably improved, which is a factor of no little importance in the present struggle with synthetic products.

A HOT GAS PROCESS.

It was mentioned at the beginning of this paper that the first serious attempts in England to deal with the phenol problem were made by Fowler. Further developments both in England and the United States have been very closely observed in Germany, but it seems that in England little progress has been made beyond the Fowler process, and attempts to use the effluents for coke quenching. In America most of the effluent is rendered harmless by its use for quenching, but considerable quantities still reach the rivers, and, as drinking water is generally drawn direct from them, great efforts have been made in recent years to find a process by which the phenols can be otherwise disposed of. Several large plants have been erected for the extraction process by benzole, and, to avoid the great steam consumption which is required if liquid benzole is used, extraction by a gaseous stream has also been tried. At a large coke works near New York a test plant was recently erected by the American Koppers Company, in which a large quantity of gas, amounting to 2000 volumes to one of liquor, is circulated in counterflow to the latter, by which 95 p.ct. of the phenol is removed, by becoming vaporized and passing from the liquor to the gas stream. A temperature of 102° C. is required for the process. The gas carrying the vaporized phenols is treated with a 10 p.ct. caustic soda solution, by which the phenols are fixed, and the rest is returned again to the process, so that the gas stream has to be heated only once to the temperature of 102°. Air or coke oven gas can be used as the gaseous wash. The consumption of 10 p.ct. caustic soda amounts to about 125 gallons per million c.ft. of gas. The comparatively weak phenol caustic soda can then be worked up to phenol oil. The plant in question treats about 100 gallons of crude liquor hourly, containing just over 100 grains of phenol to the gallon. The liquor after treatment contains only 5·25 grains to the gallon—a phenol recovery of 95 p.ct., which is all the more creditable considering the comparatively low concentration in the crude liquor.

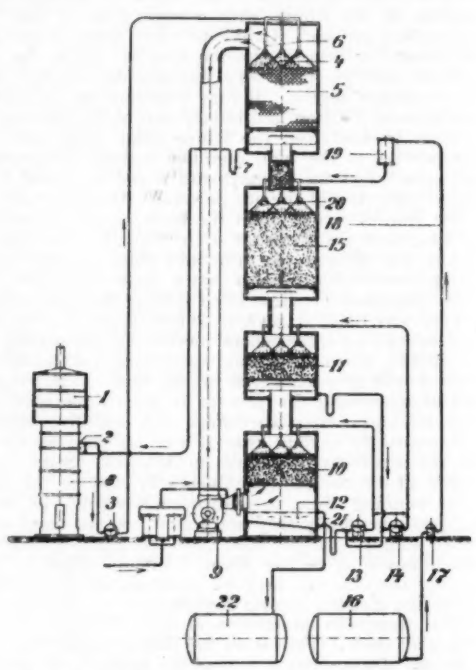


Fig. 3.—American Koppers Company's process for phenol extraction by means of a hot gas stream.

Fig. 3 shows in diagram a plant on this principle for the treatment of 30,000 gallons of liquor daily. The ammonia still is shown by 1. When the crude liquor has been relieved of free ammonia in this, it is drawn off at 2, and raised to the tower 4 by the pump 3. The top chamber 5 of the phenol washing tower is packed with small tubes of porcelain or similar material which are spirally shaped within, and the liquor is sprayed on to them through the taps 6. As it trickles through this packing, the liquor is met by the gas stream which comes from below, and it flows back, freed of phenol, by the pipe 7, to the lower part 8 of the ammonia column, where the combined ammonia is treated in the usual way with lime. The gas stream, which is kept in motion by the fan 9, becomes loaded with phenol vapour in the upper part 5 of the phenol tower, and is freed of it again under caustic soda treatment in the lower compartment. In the designing of this apparatus there were considerable structional difficulties, especially in effecting an intimate association between a comparatively very large volume of gas and a very small quantity of caustic soda; and with this in view the absorption tower is divided into three sections. The caustic soda collects at the lowest point 12, and by means of the pumps 13 and 14 it is circulated for some time within the lower sections 10 and 11, during which time it meets the gas stream, coming from below, laden with phenols. The traces of phenol remaining in the gas stream after its passage through sections 10 and 11 are removed by spraying from above with

fresh caustic soda in the top section 15. A storage tank for caustic soda is situated at 16, and the pump 17 forces it through the pipe 18 into a syphon tank 19, from which it flows to the taps 20. The syphon 19 serves the holder 15, which is filled with iron turnings. These provide a large surface to hold the liquor while the gas stream makes its way through, and so an intimate contact is achieved. The liquor trickles slowly out of section 15 and through sections 10 and 11 into the sump, whence, as already stated, it is pumped again and again to sections 11 and 12. Fresh caustic soda enters into the process from 19 at the same rate as phenol caustic soda overflows at 21 into the container 22. The whole apparatus is carefully insulated to avoid heat losses. For the contemplated capacity, the height of the phenol and absorption tower should be about 82 ft.

The American Koppers Company report that two large plants are working well on this system, but the Emscher Commission were unable to adopt it owing to the higher capital cost as compared with the benzole process, and in any case the latter meets the local circumstances quite satisfactorily. Other cases can well be imagined where such partial purification from phenols would not suffice, and in which the effluent might have to be submitted to a subsequent further treatment, such as the Bach biological process already described. The cost of the latter would, of course, be considerably reduced by the previous partial purification of the effluent.

A Large Mechanical Clarifying Plant.

After a short reference to the problem as is affects the brown coal industry, the author calls attention to the fact that the waste liquor from gas and coke works cannot be held responsible for all troubles experienced in rivers. Where, as on the Emscher, enormous quantities of tar and hydrocarbons are being continually dealt with, there is bound to be a continuous supply to the waterways of harmful neutral waste products, as well as the acid phenols. Experiments under official control have shown that the neutral and basic substances which adhere to the coal sludge and other waste from the coke works are responsible for a large share of the damage to the Rhine fisheries. It has been found that in dry weather there are always considerable deposits of sludge, containing much tar, on the bottom of the open waterways of the district, which amount in all to a length of nearly 200 miles. The disturbance of these deposits in wet weather is undoubtedly responsible for the additional damage to fisheries which is observed at such times, when the extra dilution of the phenols by flood water might be expected to have the opposite effect. At a cost of about £150,000, a huge clarifying plant has been put down recently, to deal, as regards these sludge deposits, with the whole of the Emscher water before it reaches the Rhine. The plant treats about 350 c.ft. of water per second at normal river levels, which can be increased to three times that amount when rainy weather requires it. The clarifying time averages about one hour. It is expected that nearly 9 million c.ft. of sludge will be separated out yearly, which will contain several thousand tons of tarry and oily matter. Storage capacity is limited, so that means have had to be devised for disposing of the sludge. It is fortunately possible, as a payable proposition, to dry it down to 1·5 p.ct. of moisture, and to pulverize it for use as a fuel. It is intended shortly to erect in the neighbourhood a central electric generating station where, by means of the dried sludge, it will be possible to produce some 100 million kilowatt hours of current a year.

It is hoped that the combination of the phenol extraction process and the clarifying plant will finally solve the problem of the bye-product effluents in the Rhine.

Activated Carbon for Phenol Extraction.

In a discussion following the reading of Dr. Prüss' paper, Dr. G. Müller, of Frankfort, drew attention to what, in his opinion, constituted the chief drawback to the benzole process for the extraction of phenols from effluents—namely, the enormous quantity of benzole required, amounting to about 100 p.ct. of the quantity of liquor. His Company, the Carbo Union, had tried to eliminate this difficulty by passing the liquor over activated carbon, assuming, from their knowledge of the substance, that there would be a good absorption of phenols by the carbon. This was confirmed; the carbon absorbing more than 10 p.ct. of its own weight of phenols from a liquor containing some 140 grains per gallon. The phenol was later easily extracted from the carbon by means of benzole. Quite recently, these experimental results had been confirmed by tests on a large scale in the Ruhr, and the purification efficiency was very high.

Herr Wiegmann said that the Emscher Commission had experimented on these lines at the beginning of their researches, but they had encountered considerable difficulties. They certainly achieved a good degree of enrichment of the activated carbon, but with a very watery condensate, which in turn had to be treated with benzole as already described. The carbon also degenerated very rapidly, and, in his opinion, this will remain the chief obstacle until some new substance, or new type of activated carbon, could be found to give cheaper and better service. Dr. Müller, in reply, said that his Company, too, had at first tried vaporizing the phenols out of the carbon, and he quite agreed that this damaged the carbon so rapidly as to render its use prohibitive. On the other hand, by extracting the phenols with benzole, the carbon had a much longer life, and they had even been able to use it for 100-fold absorptions.

Dr. Bach, of Essen, called attention to the numerous and complicated steps which would be involved in the activated carbon process as compared with the direct washing of the effluent with benzole. A further difficulty which he foresaw would be the fouling and rendering inactive of the carbon by the many impurities which were liable to be contained in the effluents.

PHENOL RECOVERY AND TREATMENT WORKS OF THE HAMILTON COKE AND IRON COMPANY.

By B. F Hatch, Assistant Engineer-in-Charge Stream Pollution and Industrial Waste Investigations, State of Ohio Department of Health, Columbus

From "Industrial and Engineering Chemistry."

For the past five years the attention of administrative authorities has been constantly directed toward elimination of tastes and odours in public water supplies caused by phenol or other tar acids produced in the destructive distillation of coal. During this period unceasing effort to solve this troublesome problem has been made by the bye-product coke industry in co-operation with health officials. Various methods of recovery and treatment have been attempted, and, though a large measure of success has attended the efforts to protect public water supplies, the result has been accomplished at great cost in some instances, and an operating burden of considerable magnitude has been placed on the industry as a whole. Consequently new methods of handling the problem are of especial interest to both health authorities and coke-plant officials. For this reason we present this paper describing the phenol recovery and treatment works recently placed in operation by the Koppers Company at the bye-product coke plant of the Hamilton Coke and Iron Company of Hamilton, Ohio.

Since the Koppers Company is fully protecting this process and apparatus by patents and further information may be obtained from that organization, no attempt will be made to explain minute details of design, but rather the information set forth at this time will be of general nature and as non-technical as possible.

This phenol recovery system has already excited considerable interest, and inspections of it have been made by representatives of a large number of bye-product coke companies. In addition, the works has been visited by the chief engineers of the departments of health of West Virginia and Indiana in company with the chief engineer and the writer, of the Ohio Department of Health. On these inspection trips information regarding the coke plant and the phenol recovery works has been given by Mr. J. T. Whiting, General Manager of the Hamilton Coke and Iron Company, Mr. C. L. Haldeman, superintendent of the coke plant, and Mr. J. A. Shaw, research chemist of the Koppers Company. The co-operation and courtesy of these gentlemen in arranging for the inspection trips and in giving detailed information with regard to the coke plant and the phenol recovery process are gratefully acknowledged.

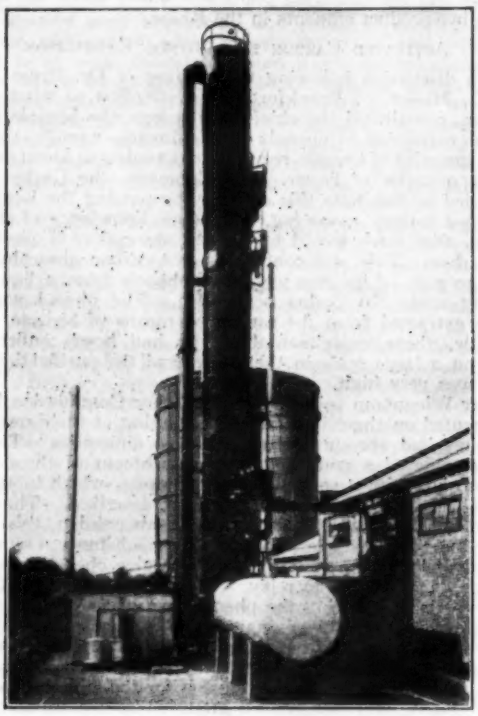
Location of Coke Plant.

The blast furnace and bye-product coke plant of the Hamilton Coke and Iron Company are located about four miles north of Hamilton, Ohio, on the west bank of Miami River. This stream is one of the larger tributaries of Ohio River and joins it about 30 miles south-west of the coke plant. Phenolic wastes from this plant, if discharged to Miami River, would first affect the water supplies of two small municipalities in Indiana which are situated on Ohio River close to the Ohio-Indiana boundary line, then that of Louisville, Ky., and other cities farther downstream.

Description of Coke Plant.

This coke plant is of the Koppers type and was placed in operation in April, 1928. The plant has 45 ovens 14 to 16 in.

in width with a rated capacity of 1200 tons of coal coked per 24 hours. At the present operating schedule 1175 tons of coal are coked per 24 hours with a coking time of about 13½ hours. Ammonia is recovered by the direct process as ammonium sulphate. The light oils are refined to produce motor benzene, and the heavy tars are sold as such. The gas after the bye-products have been extracted is purified and sold to a distributing company for domestic consumption. The coke produced is sold principally for domestic and foundry use, though sufficient furnace coke for the local plant is manufactured.



Dephenolizing Apparatus, Hamilton Coke and Iron Company, Hamilton, Ohio.

The weak liquor condensate is returned to the hydraulic main for flushing purposes at a temperature of about 76° C. At present the draw-off from the weak liquor storage tank to the ammonia still amounts to from 15 to 20 galls. per ton of coal coked per 24 hours. The volume of waste water from the ammonia still at this plant will be accurately determined by weir measurements, but probably amounts to about 30 galls. per ton of coal coked or 35,000 galls. per day. The volume of waste water from the benzene plant is probably less than 5000 galls. per day. Thus far under normal conditions there has been no draw-off from the final cooler re-circulation system. In fact, owing to evaporation which occurs in the cooling tower, it has been necessary to add some make-up water to this system. The plant water supply is pumped from a group of wells located adjacent to the plant and normally is at a temperature of 12° C.

Originally, the sewer system for the coke plant was laid out and constructed in such a manner that all phenol-contaminated waste water could be diverted to a sump near the quenching tower and used for coke quenching. This plan was later modified by the construction of a phenol recovery works and the diversion of the dephenolized ammonia still wastes, the benzene plant wastes, and any excess water from the re-circulation system of the final coolers to a pond located in a gravel and sand formation some 300 ft. from the river bank. The pond has no direct outlet, and the waste water may reach the river adjacent to the plant only by percolation through the soil.

Description of Phenol Recovery Process.

The phenol recovery and treatment works at Hamilton is the first of its type operated on a full plant scale. An experimental installation was operated by the Koppers Company for a short time at Seaboard, N.J., using about 10 p.ct. of the volume of partially distilled ammonia liquor from a 3000-ton coke plant with the direct process of ammonia recovery.

The process consists essentially in passing inert gas saturated with steam in closed cycle round and round through the hot, partially distilled ammonia liquor. At one point in the gas cycle there is placed a scrubbing section containing hot caustic soda solution. The phenol passes from the ammonia liquor into the steam and gas mixture by virtue of its vapour pressure and in the caustic section is converted into sodium phenolate, which, by reason of its much lower vapour pressure, remains in the caustic solution. Since the ammonia liquor and the caustic solution are both held at or immediately below their boiling points, and since the tower and piping are covered with insulating material, there are virtually no heat losses.

At Hamilton, the physical equipment consists of a steel tower 7 ft. in diameter and 95 ft. in height, a small blower, four small liquor pumps, two storage tanks, and the necessary piping. The operation temperatures are automatically controlled.

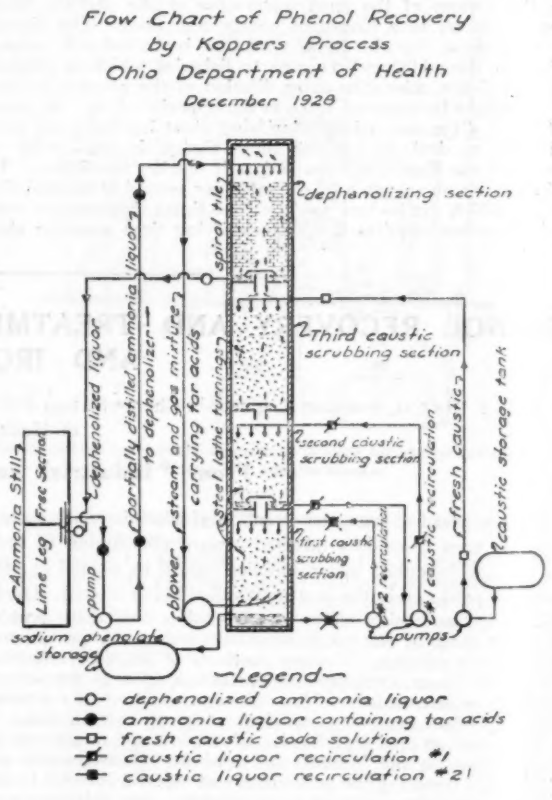
Operation of Recovery Works.

In operating the recovery works the partially distilled ammonia liquor is taken from the bottom of the free still before it enters the lime leg. The dephenolized liquor returns by gravity to a point immediately below the point of take-off.

The partially distilled ammonia liquor containing phenol and other tar acids is pumped to the top of the upper section of the steel tower and introduced by means of sprays. This tower section is filled with spiral vitrified tile in order to break up the flow into small droplets and disperse it evenly over the entire area. Against the flow of partially distilled ammonia liquor in counter-current manner is blown a mixture of about 90 p.ct. steam and 10 p.ct. air or other inert gas. As previously stated, the temperatures in the tower are held at or just below the boiling point. As the steam and gas mixture passes up through the top or dephenolizing section of the tower, the tar acids are vaporized and carried off. The steam and gas mixture is then drawn off from a point above the liquor sprays by the blower suction, passes through the blower, and is introduced into the lower part of the bottom section of the tower.

The tower at Hamilton has four sections, the top section being the dephenolizing section, while the other three are for caustic soda scrubbing. The three caustic soda scrubbing sections are filled with steel lathe turnings to ensure good distribution and intimate contact of the gas mixture and the soda solution as they pass through.

The fresh caustic soda solution is introduced into the system at the top of the third caustic scrubbing section intermittently; enough being used to keep the steel turnings in the third section constantly wet. This caustic solution trickles down through the section and spills through an opening in the bottom into the



top of the second caustic scrubbing section. It then passes down through this section, collecting in a well at the bottom. The caustic is drawn from this point by means of a pump and introduced back into the top of the same section through sprays. When the drainage from the third caustic scrubbing section raises the level of the well in the second to the overflow, a portion of the caustic solution drops into the top of the first caustic scrubbing section. Here again it trickles down through the packing and collects in a well. Another re-circulation pump elevates the caustic liquor from this well to the top of the same or first caustic scrubbing section and introduces it through sprays.

The draw-off from the caustic scrubbing system is taken

from the well at the bottom of the first caustic scrubbing section by means of an overflow to a sodium phenolate storage tank. The sodium phenolate is sprung with stack gas, and the phenol drawn off in saleable form.

The steam and gas mixture containing phenol vapour, which is drawn from the top of the dephenolizing section by the blower suction, is introduced into the lower part of the bottom scrubbing section. The mixture then passes in a counter-current manner through the first, second, and third scrubbing sections, successively, gradually losing its load of phenol vapour as it passes along. The steam and gas mixture freed of its phenol load, passes from the third caustic scrubbing section into the bottom of the dephenolizing section ready to receive more phenol vapour, and thus the process is continuously repeated. As stated previously, the dephenolized ammonia liquor returns by gravity from the bottom of the dephenolizing section to the lime leg of the ammonia still immediately below the point where the phenol contaminated liquor was originally removed. The liquor is then further distilled with lime to recover fixed ammonia.

COSTS.

Apparently the operation costs of this process are not burdensome. The phenol-contaminated liquor coming from the free still is at or just below the boiling point, and consequently the only heat loss is that required to raise the temperature of the fresh caustic solution introduced into the system to the tower temperature and radiation loss. Since the tower and piping are fully insulated, the radiation loss is low. Other costs of operation consist of power used in operating the motors which run the pumps and blower, and a very small amount of labour. Under normal conditions, the recovery works may be operated by the same men who have charge of the operation of ammonia stills. Caustic soda costs at this plant are largely charged off, because of methods that have been developed for utilization of the soda in combination as sodium phenolate. Construction costs data for this works are not available. However, the cost of equipment, exclusive of overhead, should not be excessive. Under average conditions such a plant could be completed ready for operation in about 90 days.

EFFICIENCY OF RECOVERY PROCESS.

From the standpoint of efficiency, the method is very promising. The phenol content of the weak ammonia liquor at Hamilton is between 2·5 and 3 grammes per litre at the present time. With this process the phenol content of the dephenolized liquor has usually been below 100 p.p.m., and a 95 p.ct. removal or better is readily practicable. In some instances for an extended period the outlet concentrations have been considerably below those mentioned above.

FINAL DISPOSAL OF WASTES.

As previously stated, the ammonia still wastes together with the benzene plant wastes are ponded in a gravel pit adjacent to the plant. This ponding of the wastes is an additional factor of safety at this plant against the pollution of Miami River, the stream which would normally receive the treated wastes. This stream at Hamilton has a drainage area of approximately 3660 square miles.

The U.S. Geological Survey maintains a stream-gauging station on Miami River at Venice, Ohio, about 14 miles downstream from Hamilton. The drainage area at this point is 3780 square miles. The lowest minimum daily flow on record at this station occurred in November, 1923, when the flow was 315 second-feet. During the cold-weather months of December, January, and February the lowest daily flow occurred in December, 1923, when the flow was 427 second-feet. The lowest yearly mean flow occurred during the period from Oct. 1, 1922, to Sept. 30, 1923, when the average flow was 2480 second-feet. The lowest mean monthly flow during the cold-weather months mentioned above occurred in December, 1917, when the flow was 920 second-feet.

Assuming a total phenol-contaminated waste-water discharge from a coke plant of this type of 40,000 galls. per day with a phenol content of 100 p.p.m., the flow in second-feet required to provide a dilution of 75 million parts water to 1 part phenol is approximately 463.

CONCLUSION.

From the foregoing it would appear that this process is universally applicable and may be used at any coke plant which is located on a stream or body of water of sufficient size to afford the necessary dilution for the small amount of phenol contained in the resultant waste. The efficiency of phenol removal is high, the operation of the works is simple, the ground space required is small, the costs of operation appear to be attractive; and since this process is essentially one of steam distillation, the phenol obtained should be of exceptional quality. Therefore, it would seem that with this type of apparatus advantage can be gained by constant striving for high operation efficiency, and consequently the process gives promise of being of especial merit in locations where the continuous and certain protection of adjacent public water supplies is a matter of necessity.

RAPID METHOD FOR DETERMINATION OF PHENOLS.

By J A SHAW, the Koppers Company, Mellon Institute of Industrial Research, University of Pittsburgh

Paper before the Division of Water, Sewage, and Sanitation Chemistry of the American Chemical Society.

In the course of developing the gas re-circulation method for removal of phenols from gas condensates, the Koppers Company Laboratory has developed a method for determination of phenols which has proved to be very satisfactory, particularly with regard to the time factor. The time required has been reduced from 6-8 hours for the well-known Skirrow method to about 30 mins. for the new method.

The development of the following method has enabled one man to run a very greatly increased number of tests and as a consequence has facilitated research work upon phenol removal. The words " phenol " and " phenols " are used in the generic sense in this article, and refer not only to C_6H_5OH but also to homologous and related compounds.

APPARATUS.

One steam chamber (fig. 1).
Two " Pyrex " test tubes, 8 × 1 in (20·3 × 2·5 cm.).
Three test tubes, 4 × ½ in. (10·2 × 1·2 cm.).
One Liebig condenser, 10 in. (25·4 cm.).
One set of graduated cylinders, 25, 50, 100, and 250 ml.
Two No. 5 rubber stoppers, two holes, for 8 × 1 in. test tubes.
One rubber stopper for condenser inlet.
Two 10-ml. Mohr pipettes.
Two 300-ml. bottles with stoppers for standard solutions.
One 500-ml. bottle with stopper for standard solution.
Necessary glass and rubber tubing and iron stands.
Water and compressed air connections.

DESCRIPTION OF STEAM CHAMBER.

One of the main advantages of this method of determining phenols is the short time required. Since it involves a distillation, it is necessary that the sample shall be very small or the rate of heat input high. There are various objections to using a high-temperature source of heat, one of which is the danger of charring the organic matter in the sample. It was therefore decided to employ a form of steam distillation. With a small sample, such as 10 ml., only a very small amount of either evaporation or condensation is allowable. The present system using a steam chamber was therefore adopted. The flow of hot vapour is easily and delicately controlled by the setting of the air valve. The temperature is kept almost exactly at the boiling point by enclosing the train in a steam chamber. At first, boiling water was used as the immersion medium, but steam is much to be preferred.

The steam chamber consists of two parts—a box with a **U**-shaped gutter around the outside edge at the top, and a cover, the edges of which rest in the gutter when it is in place. The box has a drain at the bottom to carry away condensate. Steam is introduced into the side about 3 in. (8 cm.) from the bottom, with the inlet turned in such a way as to direct the jet of steam towards the bottom of the box. In each end face of the top there is a slit which accommodates the inlet and the outlet tubes of the train. Steam also escapes through these slits keeping the pressure approximately at that of the atmosphere. This steam chamber can conveniently be made of galvanized iron. Ordinary pipe fittings can be used for the steam inlet and the drain. The steam chamber is mounted on a stand at a convenient height—about 15 in. (38 cm.)—above the table top so that a small graduated cylinder can be placed under the condenser.

The dimensions and details of construction are given in fig. 1.

REAGENTS.

Sulphuric acid, C.P., sp. gr. 1·84.
Bromine water.
Stock solution of phenol (1 gramme of C_6H_5OH per litre).

Standard solutions containing 30 and 35 p.p.m. phenol are prepared from the above stock solution by diluting 30 ml. and 35 ml., respectively, to 1000 ml. with water. These should be prepared fresh daily. 250 ml. of each is therefore usually sufficient.

Methyl orange indicator solution.

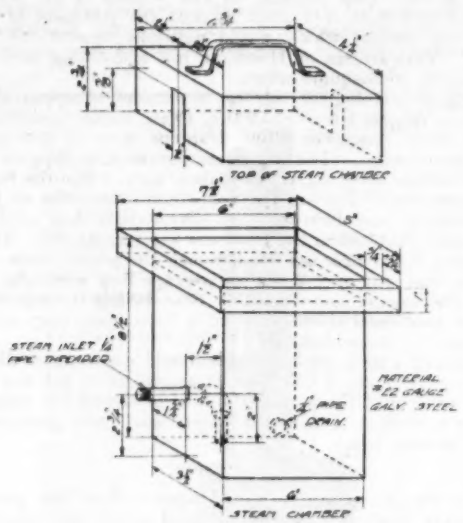


Fig. 1.—Steam Chamber.

Procedure.

The two " Pyrex " test tubes are connected by means of glass tubing and rubber stoppers as shown in fig. 2. The first tube is two-thirds filled with water. Ten millilitres of the sample to be analyzed is placed in the second tube and acidified with a few drops of 1 : 3 sulphuric acid, using methyl orange as indicator. The test tubes are then stoppered and placed in the steam chamber. The outlet from the second tube is connected with the condenser. The inlet of the first tube is connected with the air line. It is now possible to blow air through the water, then through the sample and into the condenser. A gentle current of air (in distinct bubbles at the start) is turned on, and then steam is turned into the steam chamber, the condenser first having been set to deliver into a 25-ml. graduated cylinder. The air rate should be increased during the latter part of the distillation.

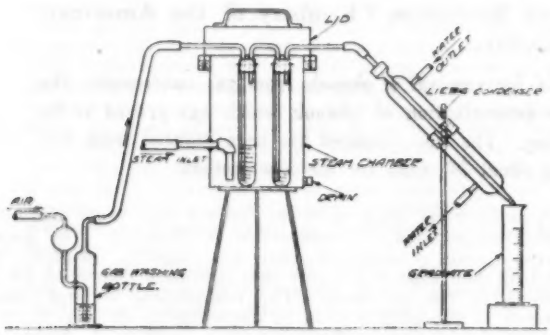


Fig. 2.—Arrangement of Apparatus.

The air passes through the hot water and becomes saturated, and the hot vapour thus formed passes through the sample and distils out the phenols without materially changing the volume of the sample. As large a volume of vapour as desired may thus be passed, and, since there can be neither charring nor dilution, very small volumes of sample can be distilled and the distillation accomplished in a very short time. When 25 ml. of distillate have been collected, the distillation has been found complete for concentrations of phenol up to 1 gramme per litre in the sample. It has, however, been found possible to distil samples of considerably higher phenol content, but a longer time and more care are required, so that 1 gramme per litre has been set as the practical working limit. When the concentration of phenol is higher than this the sample should be diluted to less than 1 gramme per litre of phenol. The distillate is mixed by shaking, and is now ready for necessary dilution and treatment with bromine water.

The actual estimation of the phenols depends upon the fact that when a solution containing phenols free from certain impurities is treated with bromine water, a colloidal precipitate is formed in the solution, and under carefully prescribed conditions the cloudiness produced thereby bears a definite relation to the amount of phenol present (1).*

For the purpose of determining the amount of phenol present, the exact quantity of the previously mentioned distillate is noted, and small portions of it are successively diluted until the concentration falls between 30 and 35 p.p.m. Three carefully sized 4 by ½ in. (10·2 by 1·2 cm.) test tubes are then held in the hand side by side. Into the middle tube is poured about 1 to 1·5 in. (2·5 to 3·8 cm.) of the sample, and into the tubes on either side is poured about the same amount of the standard phenol samples containing, respectively, 30 and 35 p.p.m. phenol. The solutions in the three tubes are adjusted to equal depth by shaking out a few drops from those containing the greatest amounts. The temperatures of the solutions in the tubes are brought to the same point by shaking for a few minutes in a water bath. The desirable temperature is 18° to 20° C. These solutions are then treated with sufficient bromine water to colour each a light straw yellow of about the same depth of colour. Usually three to four drops of bromine water is the right amount. The tubes are then closed with a clean finger and given a few violent shakes to mix.

The comparison is made immediately by holding the tubes about a foot (30 cm.) above a plain, dull, light-coloured surface in a good light so that each tube will get the same amount of light. By a little experimenting the analyst will soon determine the most suitable intensity of light for his individual eyesight. Upon looking down through the tubes (not crosswise) the degree of turbidity (not the colour) may be observed. If the dilution is correct, it will be found that the sample will fall between the two standards, and by interpolation the sample may be estimated as having 30, 31, 32, 33, 34, or 35 p.p.m. phenol concentration.

Calculation.

P.p.m. phenol in standard matched × total dilution factor = p.p.m. phenol in sample.

Discussion of Method.

The separation of phenols from contaminating substances by distillation as described above is empirical, and the procedure should be followed exactly as outlined, except when it is necessary to remove certain interfering substances as described below.

The method of distillation described has advantages not possessed by a dry or an ordinary steam distillation. A discussion of this point would require too much space here. The 10-ml. sample distilled should be slightly acid and should not have a phenol concentration of more than 1000 p.p.m. Alcohols, amines, aldehydes, organic bases, oils, and inorganic salts interfere with the bromine test. It is therefore necessary to separate them from the phenols. Oil alone may often be separated sufficiently by filtering the sample through a wet filter paper. A better method, which will eliminate many other substances as well, is to render the sample alkaline with sodium hydroxide, using enough of the caustic to make a solution containing 10 p.ct. sodium hydroxide, distil off 15 ml. as in the phenol determination, discard the distillate and wash the condenser, cool the sample, acidify carefully with sulphuric acid, and distil off the phenol as above, catching 25 ml. of distillate, &c. If, however, very large quantities of ammonium salts are present, as in saturator liquor, it is necessary to make a distillation from acid solution first and then render the distillate alkaline with sodium hydroxide (10 p.ct. free NaOH), distil off the pyridine, &c., then acidify and again distil off the phenols, catching 25 ml. of distillate from 10 ml. of sample.

Ammonia liquors that have stood for some time will often exhibit foaming during the distillation. This may usually be overcome by filtering a quantity before measuring out the sample.

As has been stated, the bromine method depends upon the formation of a colloidal precipitate. In general, anything affecting the colloidal condition interferes with this test. Examples of this are temperature, acidity or alkalinity, and salts or other substances in solution such as protective colloids or coagulants.

It is necessary that the temperature of the solution in all three comparison tubes be the same—preferably about 18° to 20° C.; hence the use of the bath of water.

It must also be remembered that while the coloration due to excess bromine should be nearly the same, it is the cloudiness, not the colour intensity, that is a measure of the phenols present.

Ordinary tap water is usually as satisfactory for the dilutions as distilled water.

Upon the addition of bromine water the tubes should be compared immediately. Not more than about 15 to 20 secs. should elapse between the bromine addition and the reading of the tests.

Since the method depends upon judging the depth of cloudiness in the solution due to the formation of brominated phenols, it is suggested that the analyst practise reading the turbidity formed in known solutions before attempting the analysis of unknown mixtures.

It is believed that the foregoing is sufficiently specific to

* Numbers in parentheses refer to literature cited at end of article.

enable any chemist to make a satisfactory determination of phenols in water solution within the apparent limits of accuracy of the test. It has been found readily possible to interpolate within two points between 30 and 35 p.p.m.

This method has been checked against synthetic solutions, against the Skirrow method (2), and has stood the test of use in engineering research calculations.

The following results were obtained by an independent analyst on samples containing known amounts of phenol:

Phenol Actually Present.	Phenol Found by Method.
Grammes per Litre.	Grammes Per Litre.
5·26	5·46
4·78	4·72
2·01	1·94
1·83	1·70
0·72	0·72
0·67	0·67
0·100	0·097
0·200	0·184

The method has cut the time required for phenol determinations from 6 or 8 hrs. for a Skirrow method to about 20 mins. for this method. One man working with two steam chambers has made twenty-five determinations of phenol in 7 hrs., and could doubtless have made more with better equipment.

It is evident that 30 p.p.m. marks the lowest concentration that can be determined directly by this method. Solutions having lower phenol concentrations, however, can be analyzed by this method if they are concentrated by evaporating in such a manner as to have a concentration of not less than 10 p.c. sodium hydroxide in the hot phenol solution at all times. It has also been suggested to the writer by Erich Laue that samples of low phenol content may be analyzed by this method if the phenol present is fortified by the addition of a measured amount of a stronger phenol solution, the phenol concentration of which is definitely known. This procedure, of course, operates at the expense of accuracy and must be used with discretion.

Phenols dissolved in oils may be analyzed by this method if the phenol is first transferred to water by washing the oil with three successive portions of 10 p.c. sodium hydroxide solution, each portion representing about 20 p.c. of the volume of the oil.

Several variations have been proposed for increasing the accuracy obtainable by this test, but almost without exception they tend to complicate the test, increase the time required, or interfere with the immediate comparison of the colloidal bromophenols. In certain special instances a little more refined technique has been employed, and a somewhat higher degree of accuracy has been obtained at the expense of the time factor. The above procedure, however, was decided upon as the best for the purpose in hand—the study of phenols in the by-product coking system.

ACKNOWLEDGMENT.

Grateful acknowledgment is made to Erich Laue for making check analysis relative to establishing the accuracy of the method.

LITERATURE CITED.

(1) Rose and Sperr, "Am. Gas Assocn. Monthly," **2**, 117, 326 (1920).
(2) Skirrow, "J. Soc. Chem. Ind.," **27**, 58 (1908).

NATIONAL GAS COUNCIL—IRISH DISTRICT BOARD.

Meeting in Dublin.

Following upon the business meeting of the Irish Association, there was a meeting of the Irish District Executive Board of the National Gas Council of Great Britain and Ireland, the chair at which was taken by Mr. Wm. J. Grey, Secretary and Accountant of the Alliance and Dublin Consumers' Gas Company. As usual all members of the Irish Association were invited to be present.

The SECRETARY (Mr. H. W. Saville, of Wexford) read the minutes of the last annual meeting, and they were confirmed.

OFFICE BEARERS.

Mr. Grey was appointed Chairman for the ensuing year; and Mr. J. D. Smith Vice-Chairman. The members of the Management Committee were re-appointed, with the addition of Mr. Airth, Mr. Ronan, and Mr. Law. Then followed the re-election as representatives on the Central Executive Board of Mr. Bruce Anderson, Mr. M'Nicholl, Mr. Smith, and Mr. Gray. Mr. Saville was also re-appointed Secretary.

ALL SHOULD JOIN.

The CHAIRMAN, in his opening remarks, referred to the vital need for all undertakings to join the National Gas Council. In this connection, he mentioned the coal marketing project, the Shannon scheme, and the call for properly organized publicity. He remarked that the activities of the British Commercial Gas Association made it the envy and the admiration of every other industry. They were now living in an age when both general publicity and specific publicity were essential; and for their satisfactory achievement the aid of an expert was required. The larger undertakings were already members of the Council, as were also a good many of the smaller ones. He urged upon those present who were still outside the Council to get their undertakings to join without further delay. By so doing, they would be rendering good service to their undertakings. All who had joined were fully satisfied that excellent value was received for the money expended. This, perhaps, was not the test that should properly be applied to the question of joining the Council; but to many of them it was an important test. He certainly did not consider that the subscription which the Dublin Gas Company paid was excessive or unjustified.

COAL MARKETING SCHEME.

The gas industry of Ireland had recently had to face important matters affecting it; and they still had to consider how closely the proposed coal marketing scheme was going to touch them. There seemed to be no doubt that an arrangement had been made between the Irish coal importers and the colliery proprietors in England representing at any rate five counties, and possibly more. There was something to be said for the colliery owners' case, because recently the majority of collieries in England had been carried on at a loss, and it was idle to suppose that this could be continued indefinitely. The arrangement come to undoubtedly was that the coal importers should pay a higher price than before for their coal. Naturally, that being one part of the bargain, the coal importers wanted to know where they came in. The proprietors had suggested that the importers came in in one or two important directions. Certain gas-works in Ireland had for many years purchased direct from the collieries. The suggestion was that direct purchases for all public utility undertakings should cease, or that, if they continued, there should be a commission paid direct to the importers of coal. This was very undesirable. They would agree with him that there was no particular objection to some scheme with the importers whereby the collieries would get a better price for their coal, so long as it did not affect the gas industry, and applied solely to the house coal trade. So far as the gas industry in Ireland was concerned, they were going to resist any such attempt to interfere with their purchases of coal. If the price of coal was to go up to every industry and to the domestic consumer, they could not expect to escape; but this was very different from what was now proposed. A meeting had taken place in London; and they hoped to have a conference with representatives of the colliery owners, so as to ascertain the best method of dealing with the proposal.

He then called upon Mr. Fottrell and Mr. Mason to address the meeting.

ADDRESS BY MR. E. J. FOTTRELL.

Joint Manager of the National Gas Council.

The year that has elapsed since I had the pleasure of addressing you in Belfast has not been particularly eventful for gas undertakings in Ireland; but I feel that it is useful, nevertheless, that we should meet to discuss not merely such matters as are of importance to a particular section of the industry, but the larger question of the whole policy of the National Gas Council and the general trend of the gas industry.

In the past ten years there has developed a strange form of mentality which has a direct reaction upon the gas industry. There would appear to have been a revolt against that traditional attitude of mind which encouraged the placing of confidence in those things which had stood the test of time. In its place there appears to have been substituted a readiness to adopt new methods without any evidence or experience of the results likely to follow in their train—to adopt them, indeed, where such evidence as was available tended to show that the results would not be identical with those which had been experienced from their application elsewhere.

THE ELECTRICITY MENTALITY.

In recent years, for instance, we have seen a tendency to make a hasty survey of the other nations of the earth to find out in what respect their industrial methods differed from ours, and, having found some points of difference, to assume that imitation of their methods would produce a like result. An outstanding example is what I may call the electricity mentality which is so conspicuous to-day, and appears to have affected England and Ireland impartially.

We saw in England some years ago the results of an inquiry

which had been made as to the quantity of electrical energy used per head of the population of different countries and different cities of the world, from which it appeared that Great Britain used about one-seventh of the number of units used per head of the population in Switzerland, and one-fifth of the quantity used by the people in Norway and Sweden.

The deduction was drawn (remarkable for a logical nation like the Anglo-Saxon) that if only five times as much electricity were used in this country, prosperity—industrial and otherwise—would follow. So great was the volume of support given to this view that Parliament actually guaranteed a sum of no less than 33 millions sterling for the purpose of making electricity more generally available, without—be it noted—any inquiry whether greater availability would involve proportionately larger use.

Here in this country to-day we are approaching the completion of a less grandiose scheme, founded no doubt upon a more logical basis, for achieving the same end. The haste with which the decision was reached to proceed with both these schemes was, I think, unfortunate. That is certainly the view of prominent electrical engineers in both countries; but I do not want it to be thought that I am dismayed by the sudden appearance in the field of a state-aided competitor. What I do complain of most strongly is the failure on the part of the public of both countries to realize the nature of the whole problem which these two schemes are an attempt to solve.

Hasty Decisions.

It was not due to any lack of energy on the part of the National Gas Council or the British Commercial Gas Association that the problem was not regarded by the public in its true light. One can only attribute these hasty decisions to an attempt to grasp at a desperate remedy which contained attractive elements of novelty and romance. Viewed in its true light, the problem becomes not an electricity problem at all, but a fuel and power problem, or, put briefly, how to employ our fuel and power resources so as to derive the maximum benefit therefrom.

As regards England, this resolves itself ultimately into a question of the rational utilization of coal. In Ireland, it becomes a problem of the utilization of water power, because coal is virtually non-existent. The important point to remember is that an abundant supply of electricity is a portion only of the problem. Electricity is not and cannot be regarded as a fuel, and any scheme which proceeds upon the assumption that electricity alone is a satisfactory source of light, heat, and power, must ultimately result in disappointment and in wasteful expenditure.

It is unnecessary here to explain why this must be so. It is sufficient to remind you that it requires 29 kilowatt hours of electricity to produce one therm. Even if electricity were available, therefore, at ½d. per unit, its cost, even if employed at 100 p.ct. efficiency, for heating purposes would be 1s. 2½d. per therm. In point of fact, electricity is rarely available at anything below 1d. per unit, in which case its cost for heating purposes is 2s. 5d. per therm.

You are already aware of the terms upon which electricity will be available. It will be supplied upon what is called the "two-part" tariff, consisting of a fixed charge based upon the rateable value of the premises, and an additional charge of 2d. per unit for domestic purposes. However low the rateable value may be, or however large the consumption, the average cost per unit cannot therefore fall as low as 2d. per unit in domestic premises, and this will represent a cost of over 4s. 10d. per therm.

Our Chairman to-day, in issuing his warning against a pessimistic view of the position, was therefore basing his advice upon the sound knowledge of the facts, but—as he also pointed out—this is not a time for relaxing effort.

A Fantastic Idea.

It is possible—and indeed, probable—that those who can afford the increased cost will be tempted to use electricity for lighting, but the idea that it can be employed as a fuel in substitution for coal, coke, or gas, is fantastic in the extreme.

Quite possibly, therefore, in many districts there will be a reduction in the use of gas for lighting, and a certain number of electrical cookers and heaters will be installed. I think, however, there is little doubt that, where an efficient gas service is available, the running costs of the electrical heater and cooker will soon result in a reversion to the use of gas, when once the sense of novelty has worn off. What is needed, therefore, is that every possible facility should be offered by every undertaking to its consumers to obtain heating and cooking apparatus on easy terms—*i.e.*, either by hire purchase or on simple hire. If steps are taken in this direction at an early date, the loss in the lighting load may well be more than counterbalanced by the increased heating and cooking load.

Should the Shannon Scheme fulfil the hopes of those responsible for it, by improving existing industries and creating fresh industries in rural areas, it is inevitable that the fuel requirements not only of these industries, but of those individuals engaged in them, should increase, and it may well come about that in meeting this new or increased demand for fuel, the gas undertakings of the country may find a fresh source of revenue. It rests with individual gas undertakings and their responsible officials, by their enterprise and energy, to ensure that the greater availability of electricity in Ireland shall not result in the decreased use of gas.

The advantage of a tariff of the kind proposed by the Electricity Supply Board might well be considered by gas undertakings. I am well aware that in the case of statutory undertakings there are difficulties in the way of its introduction. So far as England is concerned, however, the National Fuel and Power Committee have recommended that these difficulties should be removed, and I do not anticipate that any trouble will be experienced in inducing the Government Authorities in this country to effect the necessary alterations in the Statutes. The question is well worthy of consideration, and is dealt with *in extenso* in the Report of the Committee on Gas Charges appointed by the National Gas Council.

The Dundalk Rating Appeal.

So much for the subject which is doubtless uppermost in the minds of every gas engineer to-day—at any rate those situated in the Free State. There is, however, one further matter upon which I would like to say a few words—viz., the decision of the Supreme Court in the case of the Dundalk Rating Appeal. The attention of all our Irish members was drawn to the important effects of this decision, but I believe there are a large number of undertakings who still appear not to appreciate fully its possible effect upon their individual costs. It is greatly to the credit of Mr. Airth and his rating adviser, Mr. Allen, that they persevered in their efforts to secure that measure of justice in regard to the rating assessment to which they were advised that they were clearly entitled in law. I shall ask Mr. Airth or Mr. Allen to explain the position to you more fully, but I would remind you that the Act under which this decision was given is applicable to undertakings alike in Northern Ireland and in the Irish Free State, and has resulted in the case of Dundalk in a very material reduction in the amount of their rating assessment, and consequently in the amount of their annual contribution to the rates. Bearing in mind the high level of costs prevailing to-day, it is, I suggest, the clear duty of everyone responsible for the administration of an Irish gas undertaking to see that they have not to bear any greater burden of rates than the law prescribes. If, therefore, you have not considered your rating assessment in the light of the decision given in the case of Dundalk, I suggest that you investigate the position forthwith. The gas undertaking is often the largest ratepayers—and nearly always one of the largest—in its town, and if it is found that a reduction in the assessment can be obtained, it may be a material factor in influencing the development of gas sales.

Coal Prices.

In conclusion, I would refer to one other subject which I know has caused considerable interest—viz., coal prices. In view of the position in the coalfields of Great Britain, it is unlikely that pit-head prices will be reduced. A suggestion has, however, been made which, if carried into effect, would result in an artificial increase in the cost of coal to many gas undertakings in Ireland.

The suggestion is, as I understand it, that all orders for coal being imported into this country, whether for domestic use or for the use of public utility undertakings, should pass through the hands of importing merchants, and either that direct contracts between public utility undertakings and the coalowners should be discontinued, or that the merchants should receive commission in respect of such contracts. It is difficult to imagine what justification can be put forward for a suggestion of this kind, which is tantamount to a proposal that coal importers should be placed in a position to levy a toll upon the users of gas without rendering any service whatever in return.

This question was raised at a meeting which the Central Collieries Commercial Association sought with the National Gas Council. I understand that many of the Irish gas undertakings obtain their coal supplies from members of this Association. It will therefore be of interest to you to learn that the Council has accepted the suggestion of the Association that a Joint Committee should be formed to consider the question of gas coal prices, and that upon this Joint Committee are two representatives of the Council closely concerned with the gas industry in Ireland, in whose hands your interests may safely be placed (viz., Mr. Anderson and Mr. Grey). Mr. Grey may wish to say something more explicit upon this matter than I have done.

Trade Associations.

Finally, I would like to emphasize the importance of a point which the Chairman made in his opening remarks—viz., that in these days of highly specialized work, it is impossible for any one individual to be fully cognisant of the changes which are taking place in allied spheres of activity—changes which may well affect, and affect seriously, the results of his own operations. We find, therefore, an increasing tendency towards the formation of trade associations whose object it is to study the proposals of those engaged in other fields of activity, and to gauge the effect of those other proposals upon the development of the interests which they themselves serve. In no sphere is the necessity for such an organization greater than in that of

the gas engineer and manager, who is to-day expected to be not merely a sound civil, mechanical, and electrical engineer, but, in addition, a chemist and administrator. If, in addition, he were expected to be a lawyer and a politician, his life would be well nigh intolerable. It was to relieve him of the constant necessity for being on his guard against the encroachment—whether intentional or unwitting—of other interests upon his own field of operations, that the National Gas Council was called into being. We can, I think, without unduly flattering ourselves, say that its objects have been worthily pursued and largely achieved. The test of both its usefulness and its achievement must be not the benefit accruing to the individual member of the organization, but the improved conditions which the organization has provided for the individual and the difficulties which it has removed from his path. Judged by this standard, there can be no doubt that the formation of the Council was most opportune, and that, thanks to the support of its members, it has already rendered useful service. With the support of an ever-increasing number of gas undertakings, it may be relied upon to continue the useful and important work which it is now carrying on.

SALES DEVELOPMENT AND COMPETITION.

By W. M. MASON, Manager of the British Commercial Gas Association.

It has been suggested that I should submit for your consideration some points on sales development and competition. Of course, an Irish meeting is pre-eminently the place for trying to wax eloquent about competition, especially if we can slang the other fellow in strong and uncompromising language. Some of us are like Scotch schoolboys, and would rather watch a good dog fight than get on with our job. We are apt to forget that what is said disrespectfully of some of our legal friends is much more applicable to competitive controversy—viz., that the lawyer is a man who induces two others to fight, and then runs off with their clothes. If half the time devoted by some men to fighting and controversy, in the newspapers and in acrimonious correspondence, were spent in pushing their own business, the results would surprise.

In salesmanship and business building it is the positive and progressive, not the negative and retrograde, that counts. Most people, especially women, on whose goodwill the gas industry so largely depends, dislike business arguing, and all fair-minded customers (and most of us are fair-minded and reasonable folk) detest the salesman who cannot sell his own goods without running down his competitors. Some of us still have the notion that, if we could only get back to monopoly days, and chase everyone else off our preserves, we should be happy and prosperous. As a matter of fact, monopoly and the elimination of healthy competition would mean that we should soon be as dead as the Post Office.

No one knows better than we do at Headquarters how galling it is to read mis-statements, and sometimes even deliberate inaccuracies, quoted against us, but our Executive policy, arrived at after considerable experience, is to avoid being drawn into public controversy, not because we have not a good case, or because we could not state it and argue it, but because we are convinced that controversy in business, even at best, gets nowhere, and that it may indeed lead to a loss of goodwill instead of the building-up of business relationships. Some of our controversial members forget that our Executive, guiding and controlling the policy and work of the Association, consists of experienced men drawn from important undertakings who are themselves faced with the keenest competition in various forms.

The attitude to competition is of interest. Some of us do not mind telling the world and his wife that gas is the finest thing in creation, but strongly resent our competitors saying they have something as good or better. While we may not believe they have, we must give them credit for believing in their own wares, and not get annoyed at them for so doing. Far better it is to get busy pushing our own stuff.

OUR MENTAL OUTLOOK.

Let us think of our business as the newest and most up-to-date of modern systems in home convenience, and comfort, and labour saving—as indeed it is—and let us not be side-tracked by controversy. This does not for a moment suggest that a sales manager—and remember that a live sales policy in any undertaking must come from the top—should not know what his product and apparatus can do. There is no lack of information on practically any point in gas service, but the essential is to be keener on pushing our own business and in developing our own goodwill and good service, rather than allowing ourselves to be obsessed by trying to reply to our competitors' publicity—good or bad—to letters in the Press, nasty pamphlets (probably with an element of truth in them), and so on.

Salesmanship is the art of attracting favourable attention to merit or goods, of creating appreciation in the minds of the public. It enables us to make people notice things and prize them and want them. Salesmanship uses publicity and propaganda as necessary partners. Advertising showrooms, posters, literature, canvassing, demonstrations, exhibitions, controlled and handled by a keen and competent staff, are essential links in progressive policy.

The question of service to the consumer in the form of maintenance and supervision of appliances needs more attention. There is room for many schemes; and, indeed, no hard and fast rules can cover every case. The essentials in this respect are, I think:

(1) Have the will to see that the consumer has the best possible service as regards supply, pressure, and quality of gas.
(2) Provide facilities and business methods for customers to secure good and efficient appliances. Hire, hire purchase, favourable sale, and so on should be instituted and encouraged.
(3) Organize inspection and maintenance staff for keeping apparatus in good working condition. The questions of providing a new organization in this respect, and whether obviously essential service should be charged or be inculded in the price of gas, are points for discussion. On the question of cost, many progressive men in the industry are convinced that we cannot afford to do without adequate and regular maintenance of consumers' appliances.

The "B.C.G.A." can supply members with practical schemes for installing and operating maintenance and inspection work. The sales manager of one of the most progressive gas undertakings in the North of England, where competition is probably keener than anywhere else in the United Kingdom, made the following good points:

(1) Remember, advertising is not a load on the purchaser; it is a factor resulting in benefit to the purchaser.
(2) If by publicity our customers are taught to use more gas with benefit to themselves, the effect on standing charges is immediate and continuous. Moreover, to increase the public demand for a useful product is a public benefaction. It is therefore our duty to make known our goods and the service we offer, in order to cheapen the supply to the public whom we serve with one of the necessities of modern civilization.
(3) The Newcastle Company spends more than many undertakings on local publicity. The sum has been increased each year, as the Directors are satisfied that the results justify the expenditure. I do not think we have yet reached our maximum.

In the large majority of businesses the actual sale of the product is the beginning and ending of the business relationship. In the gas industry the reverse is the case. When the customer becomes a consumer of gas his relations with the gas supply undertakings have commenced, not terminated. If, therefore, it pays the ordinary business to advertise, how much more will it pay a gas undertaking, who will profit not once, but continuously?

THE REAL DANGER.

It is possible to be too complacent about our duty to the consumer, and to think that the contribution to national publicity and national safeguarding is quite sufficient. This is a real danger, especially to the manager who has not a progressive board and who has difficulty in getting his national contributions passed; but conditions to-day—and they will undoubtedly be no easier in the future—demand up-to-date ideas and methods in dealing with the public if custom is to be retained. Political and other influences have arisen which put a very different complexion on selling gas from what the industry conceived to be necessary even twenty years ago. National and local publicity are essential spokes in the wheel of business; but they are only part of the scheme. They cannot take the place of first-class showrooms, with competent staffs, and all the circle of service whereby satisfied consumers may be secured and retained. Customers with grievances, whether real or imaginary, are the easiest victims for our competitors.

That there is plenty of business to be secured by the keen salesman who is consistently working for it has been proved, and is being proved, to-day. Great and astonishing new outputs are being secured, but they have to be worked for by keen and competent men. They will not fall into their laps, and the forward policy must come from the manager and the board. I make no apology for the following quotation from a prominent public man:

"Salesmanship is not just handing something over the counter. It is service; and the service only begins when you have sold a thing. It does not end until you have got all the repeat orders and some more besides. The customer is always right. It does not matter how wrong he is, he is always right, and the wronger he is the more right you have got to treat him. His complaints, if you see them properly, are of great value. If the complaint is quickly followed up, the complainant becomes an advocate before you know where you are."

The wise attitude to competition, continued Mr. Mason, is not to grumble or rage at or curse the people in opposition—the electricians, the oil magnates, and, indeed, all the other

business folk who are pushing their goods and crying their wares loudly and effectively. Rather let them emulate the athlete or racing man who, when the pace gets hot, grits his teeth and puts forth his best effort.

SUGGESTIONS FOR SMALL UNDERTAKINGS.

In conclusion, Mr. Mason offered the following suggestions for small undertakings: (1) Take a census of the present and potential field. (2) Local publicity, backing-up the national scheme, by means of posters, accounts, &c. The goodwill of local newspaper editors should be cultivated in order that gas may have a show in the editorial as well as in the advertising columns. (3) Showrooms. An undertaking is judged by its showrooms. Compare them with other shops, secure good position, and have them well equipped and staffed with keen, competent salesmen. (4) Literature, education, and reasoned arguments. Reductions in price should always be well boosted. (5) Complaints. Special attention should be paid to the talkative consumer.

Discussion.

Mr. F. J. EDMONDS (Waterford) proposed a hearty vote of thanks to Mr. Fottrell and Mr. Mason for their addresses, and to the Chairman for his remarks. He appealed to those who could assist in this matter to see whether something could not be done to obviate the disadvantage from which they suffered in Ireland of excessive breakages in transit. It had, he said, been found that sometimes 50 p.ct. and even as much as 75 p.ct., of the cookers received were damaged. This was a great obstacle in the way of increasing efficiency.

Mr. T. J. REID (Ballina), seconding, said he had tried already that day to ascertain the views of the members as to what would be the correct attitude to adopt towards the Shannon scheme. They must do everything they could to meet the situation.

A CENTRAL SHOWROOM.

Of course, a good showroom was a valuable asset to any gas concern; but the members of the Association were mainly concerned with small undertakings, so that the capital outlay involved in providing numerous up-to-date showrooms in different places would hardly be justified. Why not have a central showroom (say, in Dublin) to which people from the country districts could be directed? The electrical industry had something of this kind. Could not the gas industry support one showroom which would meet the wants of the surrounding undertakings? Such a showroom might possibly be worked in conjunction with that of the Dublin Gas Company. That was an admirable showroom, but it might be made more public. Perhaps a Committee of the Association might be appointed to deal with this matter.

RATING QUESTION.

Mr. J. H. ALLAN, F.S.A. (Dublin), referred to the question of rating in connection with the Dundalk case. He said that those undertakings which had not had the Dundalk judgment applied to them were paying rates on certain machinery which was expressly excluded, not only by the Supreme Court, but by Statute. The remedy was in the hands of the undertakings themselves. They should move to have the judgment applied to them.

COMPENSATION FOR LOSS OF PUBLIC LIGHTING.

A MEMBER inquired as to the possibility of gas undertakings securing compensation when the public lighting was compulsorily taken out of their hands under the Shannon scheme. An effort to obtain this could be better made by the Association than by the gas companies themselves individually. If the public lighting was taken away from them there certainly ought to be some compensation.

ADVANTAGES OF JOINING THE NATIONAL GAS COUNCIL.

Mr. R. BRUCE ANDERSON (London) dealt with the advantages derived from subscribing to the National Gas Council. For one thing, he pointed to the fact that those who had adopted the Council's scheme in connection with workmen's compensation had saved in premiums alone more than the annual subscription to the National Gas Council. Most of the works in Ireland were very small; but the minimum subscription to the Council, which included that for the British Commercial Gas Association, was no more than one guinea. Thus by getting in all the small undertakings the National Gas Council would not gain financially, but they would gain by being able to say that they represented the whole of the gas undertakings in the country. Under the Gas Regulation Act, they all had to have their meters stamped. As originally proposed, this would have had to be done within a year. When, however, the measure was going through, the National Gas Council were approached; and they appointed a small Committee, who handled the question in such a way that the period of one year was extended to five. Meters had to be re-stamped once in every ten years. This period was originally intended to be a shorter one. There were only two stamping stations in the Free State, at Dublin and Cork; and in many cases heavy cost would be incurred in carriage of meters. In the Electricity Bill extremely valuable clauses were inserted at the instance of the National Gas Council. He then proceeded to explain the main provisions of the Queenstown Special Gas Order, in which some benefits had been secured which had not previously been granted by the Board of Trade. One gave them power as a sliding-scale undertaking to pay back-dividends out of future profits. This would permit them to make reductions in the price of gas which they might otherwise hesitate to do. He would urge all who intended going for Special Orders to copy the clauses in the Queenstown Order. Under it, they could raise the price of gas without having to reduce the dividend below a certain figure. They had also consolidated their various classes of stock. There had been some serious accidents in Ireland within the last three or four years; and the brokers had been putting up compensation premiums. Some members had parted from the National Gas Council brokers in consequence; but he appealed to them all to support the Council's brokers, even at a small increase, because if the Council's scheme went under the other brokers would doubtless raise their fees still further. As to tar, they had been trying to get too high a price. If they had been content to let the Road Board have it at a more favourable figure, bitumen would never have come in. Sufficient business had been lost to make it a serious question as to what would become of the surplus tar in future.

URBAN DISTRICT COUNCIL'S POSITION.

A MEMBER asked what was the position of Urban District Councils, who could not, under the regulations, subscribe to such bodies.

Mr. A. S. BROOK (Lisburn) said it was difficult sometimes to impress the Auditor with the necessity of doing so; but it was quite in order, and many had been successful in getting it passed.

Mr. SAVILLE pointed out that it had been passed by the present Secretary of the Local Government Board when he was himself an Auditor.

STICK TO THE LIGHTING.

The CHAIRMAN, acknowledging the vote of thanks, which was heartily accorded, remarked that Mr. Fottrell had said it was inevitable that some gas lighting should go. He (Mr. Grey) disagreed entirely with every one of these words. ["Hear, hear."] He did not think it was inevitable that any lighting should go. Dublin had the biggest gas undertaking in the Free State; and certainly in his time, which only covered a period of some fifteen years, their output of gas had very nearly doubled. They might be surprised to learn that of this increase a very substantial portion had been in connection with gas lighting. There was another significant fact bearing upon gas lighting in the city. It was doubtless within the knowledge of those present that the Dublin Corporation from time to time within recent years had launched quite a number of building schemes. They had taken the precaution first of all to wire the houses for electricity. The Gas Company were usually told that there was no objection to them running a supply, as it might be required for cooking purposes. This was done, and the result in connection with almost every one of these schemes had been that electricity for lighting was put out and gas lighting was put in. This did not reconcile itself with the statement that it was inevitable that some gas lighting should go. It was, of course, possibly inevitable in a very minor sense. Some big stores, &c., might find electricity more convenient; but, as against a small loss like this, the gas industry could, if it liked, gain a great deal more. "Do not," said Mr. Grey, "let us strike a note of pessimism, for optimism is required. Optimism is the note we should strike to-day."

SHOWROOM QUESTION.

Continuing, Mr. Grey said that for many small undertakings a special showroom was out of the question; but every concern must have some sort of an office, and he could not see why, at a comparatively small expenditure, these offices could not be turned into quite small showrooms. His Company had in contemplation an alteration of their existing building, so as to turn it into a first-rate showroom. This could be done in many of the offices in the country. Mr. Reid had suggested a national showroom; and this seemed to him a very good idea. So far as Dublin was concerned, he thought they had never failed to run their showroom at a profit; and if this was so, it seemed to him that any objections which might be raised against national showrooms were already answered. On the question of compensation for loss of public lighting, a great deal must depend upon the facts of each individual case. He could not see anything to prevent the Electricity Commissioners taking over electrical undertakings, and saying that in future they would supply the public lighting; and this being so, he felt some doubt as to whether compensation was ever likely to be secured by any gas undertaking in connection with the loss of public lighting. Mr. Bruce Anderson and himself were members of the Committee of the gas industry who proposed to meet the coalowners. He had reason to believe that it was intended forthwith to attempt to stop gas undertakings selling coal as coal; and in the Free State there were a considerable number of undertakings selling coal at a profit which had helped them to keep down the price of gas. Such a proposal, which would prevent gas undertakings carrying on a legitimate trade which they had enjoyed for years, appeared to him to be very arbitrary.

Mr. FOTTRELL said he was very glad Mr. Grey had expressed disagreement with his remarks about lighting. They were, of course, as Mr. Grey had remarked, intended to apply in a very minor sense. So far as gas was concerned, he must confess himself an incurable optimist.

Coal Distillation Plant in Staffordshire.—The first coal distillation plant in Staffordshire is in course of erection in the Cannock Chase Coalfield area. The Vandergrift process, which has been successful in the United States, is to be used, and the site of the new venture is at Leacroft, Cannock. The plant will be adjacent to the Leacroft Colliery Company's pit, and there will be no expense in the transport of coal to the retorts. At first 1400 tons of local coal will be required weekly, but it is expected that the initial plant will be extended, and eventually 1000 tons a day needed. Among the products extracted from the coal by the process will be benzole, tuluole, light and heavy oils, and tar. After the extraction, the coke, it is stated, will burn in an ordinary grate, will give off good heat, and will be smokeless. We understand that it will be put on the market at a reasonable price.

SELLING GAS REFRIGERATORS IN NEW YORK.

By HERBERT KERK.

From the American Journal "Sales Management."

The Consolidated Gas Company of New York during 1928 set the remarkable record of selling one-sixth of all the gas refrigerating machines sold in the United States, entirely through leads developed according to the plan described in this article.

Selling the "Electrolux" gas refrigerator since January, 1927, the record of the Consolidated Gas Company of New York is: Sold in 1928, one-sixth of all the gas refrigerators in the United States. In numbers, this is 5345 refrigerators, out of a total for that year of 32,000 for the whole country.

The increase of the second year's sales over the first was 639 p.ct. with 1927 sales equalling over 836 and those for 1928 amounting to 5345. Already for the first five months of 1929, the poorest of the year, since the peak is reached in July, the Consolidated Gas Company has sold:

January	572	refrigerators
February	490	,,
March	1214	,,
April	1395	,,
May	2503	,,
Total	6174	,,

This outlined record represents another achievement. In the two years the gas refrigerator has been sold by the Consolidated Gas Company of New York, its dollar sales have netted the merchandising department almost as much as the gas range—the largest item and a staple for 30 years. The 1929 dollar value for the gas refrigerator will far exceed that of the gas range if its rate of selling for the first five months of this year continues, according to Nils T. Sellman, Assistant Secretary, in charge of all sales.

Refrigerators are sold wholesale to the building owner, and retail to the homeowners, Mr. Sellman said. In Manhattan and the Bronx, the building sales are by far the larger (85 p.ct. building and 15 p.ct. retail) with the reverse true in Westchester County. Not only is there a profit in the sale of the refrigerator, but there is added business in the load it builds. This is particularly true and advantageous to the Company in the case of the small apartment dweller, whose use of gas for his range hardly pays. The added load of $1 to $2 for the gas used by the refrigerator turns this unprofitable load into a profitable one.

Selling to owners and architects of new building projects is done by a special force of four salesmen. The same number goes after completed apartment buildings. Seven more salesmen handle nothing but the retail trade. In outlying districts, such as Westchester and Queens, there is not this specialization; and, through subsidiary sales forces, both the building and the retail sales, as well as all electric and gas appliances sales, are handled by the same men.

SELLING NON-SEASONAL.

The building sales force contacts both builder and architect, and for each division of the whole sales organization specialized sale effort and training are required. The salesman operates on salary and commission. For the good salesman commission represents the larger part of his income. One salesman sold 615 machines to builders in three months, for instance. All salesmen are kept on through the dull as well as the good months. The increase in sales with each succeeding month has made selling practically non-seasonal, taking care of, by increased volume, what would ordinarily be a slump. Supporting the sales force is a service organization of seven outside men, 70 installation testers, and three laboratory engineers. This force is constantly added to each year by a training course.

Leads keeping this sales force busy for two years were secured from the following sources: Newspaper advertising, direct mail, plumbers, employees, and building and newspaper real estate reports. A co-operative newspaper campaign in the metropolitan area was launched by these Gas Companies serving the district: New York and Richmond Gas Company, Brooklyn Union Gas Company, Consolidated Gas Company, Public Service Company of New Jersey, Kings County Lighting Company, Westchester Lighting Company. Electrolux, Inc., the manufacturers, also participated. Leads were not specially sought in this campaign of large space advertisements, and therefore few coupons were used. The copy was intended to act as a background for general sales effort.

Direct mail references to the refrigerator were made in a few of the year's monthly billings. When these offered a booklet, and with it a request-for-salesman's call card, one of every five of these leads resulted in a sale, as against one sale of every 20 inquiries when no explanatory booklet was read by the inquirer.

Through 35 plumbers whose size and showroom arrangement make possible a fine display of a full line of refrigerators, many leads were secured. These plumbers in some cases sold direct and earned the full agents' commission—from January to the end of April of this year 69 refrigerators were sold by these dealers. In certain instances, the specialist-salesmen of the Gas Company were called in. All the other plumbers throughout the city were supplied with placards for window display, and offered a standing commission for leads that might result in calls and inquiries. Over the two-year period, one of every 10 of these leads has resulted in sales. If any of these plumbers sold a machine through his own efforts he was entitled to the full agent's commission.

EMPLOYEES FURNISH LEADS.

Another source of leads was employees of the Company. Through announcements in house organs, talks, and bulletin posters, a fixed bonus arrangement (the same for all sizes of refrigerator) was given to any employee for a lead which resulted in a sale. Regular showroom salesmen are offered a similar bonus for leads which they turn over to the special retail sales force. Some of these floor salesmen have averaged a lead a week which has resulted in a sale.

In turning-in leads, both employees and plumbers fill up a simple form in triplicate—one copy for the employees' file, another for the salesman who is to follow up, and the third for the salesman's office manager. In the plumber's form, which is larger than the employee's, space is left for the plumber's business card, otherwise the forms call for the same information. As soon as a lead comes in, it goes to the refrigerator division, where it is immediately checked with prospects.

Most retail leads brought in by employees are not already found on the prospect list of the sales force. An average on follow-ups was one sale from every six leads. In the first four months of 1929, approximately 245 leads have been developed by employees.

In the case of building job leads, few leads are new. Two notable exceptions to this, one of leads brought in by an employee in the construction department which resulted in a sale of 296 refrigerators, and one of a lead from another employee which amounted to 80 machines, indicate the value of offering an incentive for each employee to keep his wits sharpened for possible business in closely followed-up sales work such as the building division, where leads develop from the building reports and announcements of new buildings or changes in the newspaper real estate sections. An immediate follow-up of these leads, *plus* constant contact with leading builders and architects, has kept this department more than supplied with work.

INSTALLATIONS IN GROUPS.

Close contact with builders and architects, *plus* concentration in districts, has resulted in spectacular chains of sales. On the pin map of the sales territory, installations are bunched in groups throughout the city. This happens not only because new building takes place in booms in different sections of the city, but also because the building department salesmen have made it a point to use the adoption of the refrigerator by one builder a sales tool to get business from his neighbouring builder. In a lower section of the Bronx, a close concentration on one section has resulted in the sale of 844 refrigerators since November, 1928. In this district, the salesman got his wedge in when he convinced a builder to use gas refrigerators instead of 20 electric refrigerators. With the contract from this builder, the salesman approached another builder two blocks away, and persuaded him to equip his new apartment with 126 gas refrigerators. The next buyer in the neighbourhood purchased 225 gas refrigerators, followed by 248 from another, 185 from another, and 41 from still another, all of these builders being near, and all acting in part upon the decisions of their local competitor. The first builder in the neighbourhood, who had already installed electric refrigerators before the salesmen got to him, is so convinced by what his competitors are doing that he is installing 20 gas refrigerators in one of his old buildings not mechanically refrigerated.

Bye-Product Tar in America.—Over twelve million gallons of creosote oil, and 57,000 gallons of phenol, were produced by distillation of coke oven tar in America in 1928. The total tar production was 631,845,000 gallons; and of this quantity 257 million gallons was used in metallurgical plants and 4 million gallons was burned under boilers.

MISCELLANEOUS NEWS.

DR. WALDO'S SUBWAY RECOMMENDATIONS.

Report to the Home Secretary and the Lord Mayor of London.

Dr. F. J. Waldo, H.M. Senior Coroner for London, in his recently published statutory report under the Special Local City of London Fire Inquests Act, 1888, to the Home Secretary and Lord Mayor, following upon his inquiry into the Victoria Embankment subway fire, makes the following recommendations.

(1) The holding of a public Government inquiry into the whole subway question.
(2) An amendment of the L.C.C. (Subway) Act, 1893, removing the obligation to place gas mains in the nineteen L.C.C. London subways in juxtaposition with electric cables.
(3) The removal or replacement of the gutta percha inflammable insulation of the Exchange Telegraph (Tape) Company subway cables by a more recognized and efficient method of insulation.
(4) That all dormant cables—including those of the City of London Electric Lighting Company—be removed from the subways.
(5) That all subways should be permanently wired for lighting according to Institute of Electrical Engineers' Rules, and to eliminate all portable means of illumination.
(6) That the question of the inadvisability of associating gas mains and electric cables of any kind in a subway should be carefully considered by all the local authorities concerned.

Dr. Waldo says: "The presence of two large gas mains, 36 in. in diameter, in the lower part of the subway, constitutes an obvious danger in the event of fire." Also that "the high tides in the Thames of January, 1928, filled the subway with water, and apparently led to the damage of electrical plant which was answerable for the defects that caused the first three fires (of Sept. 8, 16, and 30, 1928). It also floated the gas mains upwards towards the roof of the subway, and caused faults in the joints of the mains. This was followed, as Mr. Escreet, Assistant Distributing Engineer to the Gas Light and Coke Company, said in his evidence, by a considerable and dangerous leakage of gas." To a question put as to whether there might not have been a fatal explosion with many deaths accompanied by the breaking down of the Embankment wall followed by flooding, Mr. Escreet replied, "Yes. I do not know what might have happened."

Dr. Waldo, in his report, says that "since his three inquiries, *inter alia*, steps have been taken to lessen the risk of future fires and explosions, and that the Fire Officers are now informed as to the various electrical companies having cables in the subway, so that currents can be at once cut off on the occurrence of a fire in the subway." Dr. Waldo goes on to say that "the efficient ventilation of the Embankment subway probably prevented a serious disaster from gas explosion in the four fires that have occurred in the Victoria Embankment subway. In the fire of Sept. 8, 1928, investigated by me, all the joints—25 in number—of the two 36-in. gas mains covering a fire area of 45 yards, were found to be leaking."

Dr. Waldo, in his statutory report on the fires of Sept. 8, 16, and 30, 1928, in the Embankment subway, said "matters were ripe for a big explosion of an earthquake nature."

LARGELY INCREASED SALES AT ROTHERHAM.

More Crude Gas Supplied to Manufacturers.

The annual report of the Engineer and Manager of the Rotherham Corporation Gas Department (Mr. T. R. Cook), for the year ended March 31 last, shows that during the year the gas consumed in the Rotherham area of supply amounted to 382,802,000 c.ft., and, in addition, 122,226,000 c.ft. of crude gas has been sold to manufacturers under contract. The total gas sold for all purposes amounted to 505,029,000 c.ft., as against 376,059,000 c.ft. sold during the year ended March, 1928, giving a total increase of 128,970,000 c.ft., or 34 p.ct. for the year.

The amount received for all gas totalled £61,816, which is equivalent to 2s. 5·37d. per 1000 c.ft., as against an average price of 3s. 5·07d. per 1000 c.ft. for the year ended 1928. This reduction is due to a decrease in the charge for gas, and also to the sale of crude gas to manufacturers at a low figure.

The net capital indebtedness at March 31, 1929, was £115,976. The total capital spent during the year was £13,200 for purifiers, mains, meters, cookers, gas fires, boilers, and fittings.

The gross profit for the year amounts to £23,434, and, after deducting interest and sinking fund charges of £11,132 and income-tax provisions of £6976, there remains a net profit of £5326. From this account must be deducted £3439 for the gas given free for street lighting, leaving a surplus profit of £1887.

The Engineer and Manager advises that this surplus be placed to the contingent fund making certain provisions for the proposed new offices and workshops. If the Committee support this recommendation, the total amount of the contingent fund will be £3822 for the year ended March 31, 1929.

During the year, the No. 1 gasholder has been repaired at a cost of £1260, and the river wall has been considerably strengthened by the Francois cementation process at a cost of £676. The test plant building and store shed has been demolished and the ground space cleared. The charge for these items has been met out of revenue during the year. On the capital account two purifiers were erected as an extension to the existing house. A new gas engine has also been installed to drive the boosting plant for high-pressure lighting.

The total quantity of gas sold during the year was:

Meters. Ordinary. C.Ft.	Meters. Prepayment. C.Ft.	Lamps. Public. C.Ft.	Lamps. High Pressure. C.Ft.	Crude Gas. C.Ft.
139,319,000	201,267,000	38,722,000	3,494,000	122,226,000

Total. C.Ft.	Increase on 1928. C.Ft.
505,028,000	128,969,000

ELECTRICAL COMPETITION.

During the year the Department have met very keen electricity competition due to the assisted wiring scheme, and it is estimated that 1000 gas consumers adopted electricity for lighting. The Distribution Department have been extremely energetic in this field, which has resulted in 300 of these consumers reverting to gas as a lighting agent, or a return of 33⅓ p.ct., which is very satisfactory. Also during the year 8000 new gas fittings, consisting of pendants, burners, and brackets, have been fitted, and it is estimated that this total will reach 16,000 for the year ending March, 1930. The elimination of cheap, shoddy fittings will greatly assist in the retention of the lighting consumers.

The orders for apparatus taken through the showrooms are as follows:

—	Sold.	Hire Purchase.	Simple Hire.	Total.
Cookers	39	37	1105	1181
Fires	81	164	122	367
Water heaters	43	25	3	71
Gas boilers	2	4	..	6
Burners and grillers	57	1	..	58
Gas fittings	70	..	..	70

The Department have also fixed up two gas-fired boilers for heating and steam raising purposes.

During the year, 301 service pipes were laid and 608 new meters fixed; the total number of meters in use at the end of the year being 19,859—an increase on the previous year of 466.

The total number of public lamps in the district of supply at the end of the year was 1719, and these have been lighted for a total of 3675 hours during the year.

SCHEME FOR SUPPLYING CHEAPER GAS IN GLASGOW.

Important Outside Offer to Corporation.

An offer has been made to the Glasgow Corporation by one of the largest firms of coalmasters in the city to supply at a low price a quantity of gas up to 10 million therms per annum.

The Gas Committee of the Corporation has had the matter under consideration, and has remitted it to a special Sub-Committee composed of the Conveners of the five Sub-Committees. A group in the city of those interested in the proposal considered the question at a meeting on Aug. 15, and a report will be submitted to the special Sub-Committee this week.

A year or two ago the Corporation entered into a contract with an outside company for a supply of gas to augment the quantity manufactured municipally, and the price being paid under that contract is a fraction under 11d. per 1000 c.ft. The new offer, it is understood, is to supply gas at less than 2d. per therm, and as there are approximately 4·7 therms in each 1000 c.ft., it will be seen that the figure is lower than that which is being paid to the outside company at present sending in a supply, whose contract comes under review a year hence.

The plant from which the gas is to be obtained is situated very near to the boundary of the city, and consequently comparatively little additional piping will be required. It is probable that the offer to supply 10 million therms per annum is purely experimental, and that, should the quality be thoroughly satisfactory, a much bigger contract might be arranged.

Medical Officer's Appeal to Housewives.—The Medical Officer of Health for the City of London, in his annual report just issued, makes a strong appeal to housewives to use smokeless fuel. "The domestic chimney," says Dr. Willoughby, "still remains uncontrolled, and continues to contribute very largely to the fogs to which London and other large cities are from time to time subjected. No really satisfactory reduction of this smoke nuisance is likely to be effected till the domestic source is attacked, and this does not seem to be within practical reach till some smokeless fuel is produced which can be used in the open ventilated grate and which will burn with that firelight effect so precious to the average English housewife. That these fuels are available I am aware, as I attended demonstrations of two of them. In each instance the results were extremely satisfactory, and I suggest that the time may not be far distant when we may enjoy the open grate conscious that we are no longer contributing to the atmospheric impurities which are undoubtedly responsible in a wide measure for pulmonary affections."

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Aug.* 19.

A fair amount of business is reported in pitch for delivery during the coming season, and the price is steady at not below 45s. per ton f.o.b. Buyers are interested for autumn next year; but makers are at present disinclined to sell so far ahead.

Creosote is unchanged, the export price being called 6¼d. per gallon f.o.b.

Pure toluole is firm at 2s. 2d. and 2s. 3d.; solvent naphtha 95/160 is steady at about 1s. 5d. per gallon; and pure benzole is 1s. 11d.

Pyridine bases are about 3s. 9d. to 4s. per gallon.

Tar Products in the Provinces.

Aug. 19.

Markets for tar products are, generally speaking, steady.

Pitch is firm. Apparently there are no sellers at under 45s. per ton, and at this figure some business is being done. Inquiries for delivery in the autumn of next year continue, and purchasers are still refusing to consider same.

The market for creosote is quiet, but steady.

Crude carbolic acid. There is still very keen competition for any material which comes on to the market.

Cresylic acid. The market for this article continues very quiet indeed.

Crystals carbolic. Manufacturers are asking 8d. per lb. for prompt delivery.

Pure naphthalene. There is a fair demand for this article.

Water-white products prices remain steady, and a fair amount of business is being transacted.

The average prices of gas-works products during the week were: Gas-works tar, 23s. to 28s. Pitch—East Coast, 45s. f.o.b. West Coast—(f.a.s) Manchester, 39s. 6d. to 40s.; Liverpool, 43s. to 44s.; Clyde, 43s. to 44s. Toluole, naked, North, 1s. 7¼d. to 1s. 8¼d. Coal-tar crude naphtha, in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 1s. 3⅜d. to 1s. 4½d. Heavy naphtha, North, 1s. to 1s. 0½d. Creosote, in bulk, North, liquid and salty, 3¼d. to 3½d.; low gravity, 2d. to 2½d.; Scotland, 3¼d. to 3½d. Heavy oils, in bulk, North, 5½d. to 6d. Carbolic acid, 60's, 2s. 4d. to 2s. 5d. prompt. Naphthalene, £13 to £15. Salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.c., purely nominal; "B" quality, unsaleable.

Benzole Prices.

The following are considered to be the market prices to-day:

	s. d.	s. d.	
Crude benzole . . .	0 10	to 0 11	per gallon at works
Motor ,, . . .	1 5	,, 1 6	,, ,, ,,
90 p.ct. ,, . . .	1 7	,, 1 8	,, ,, ,,
Pure ,, . . .	1 10	,, 1 11	,, ,, ,,

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

Markets are strong all round for all early positions, and in fact for the remainder of this year. Inquiry is plentiful, and boats are coming forward more regularly, so that, with considerable quantities already sold, it looks as though prices should be well maintained.

Owing to uncertainties connected with selling schemes, hours, and wages, business is not easy to negotiate for next year. A certain amount is, however, being done, upon the basis mainly of about 16s. f.o.b. for good quality gas or coking coals.

Current quotations are 17s. 6d. f.o.b. for Wear Special gas, and 16s. 9d. to 17s. for best qualities. These classes are in excellent demand, and are strong. Second-class gas are 15s. 6d. to 15s. 9d., and fairly plentiful at present. Coking are stronger on the week, best unscreened being firm at 16s. 9d., with others 16s. 3d. to 16s. 9d., and good smalls being as much as 15s. 9d. Best Durham bunkers are strong at 17s., and seconds ask 15s. 6d. to 15s. 9d. Northumberland steams are enjoying brisk trade, and best qualities are booked for some weeks ahead. For best screened sorts, 15s. 6d. to 16s. is firmly quoted.

Current demand for gas coke is quiet; but prospects are regarded as favourable, and 21s. 6d. f.o.b. is steadily quoted for shipment.

YORKSHIRE AND LANCASHIRE.

As a result of the reduced prices of large steam fuel business has been slightly stimulated, but exporters refrain from making substantial forward arrangements. The market is more favourable to buyers; but late quotations of 18s. to 18s. 6d. per ton f.o.b. for best hards are being asked by the collieries. Secondary sorts are not so strong, and there is keener competition among the collieries to secure business. The home inquiry for industrial fuel remains practically unaltered.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports:

South Yorkshire—Hards, Association, bunkers 18s. 9d. to 19s. 3d., export 18s.; screened gas coal, export 18s.; washed trebles, export 18s.; washed doubles, bunkers 18s. 9d., export 17s. 6d.; washed singles, export 16s. 6d.; washed smalls, bunkers 16s. 3d., export 15s. 6d.; rough slack, bunkers 13s. 6d. to 13s. 9d., export 12s. 6d. to 13s.; smithy peas, export 19s. to 19s. 6d.

West Yorkshire—Hartley's (f.o.b. Goole), bunkers 17s. 6d., export 17s. to 17s. 6d.; screened gas coal, export 18s. to 18s. 6d.; washed trebles, export 17s. 6d. to 18s.; washed doubles, export 16s. 9d.; washed singles, export 16s.; washed smalls, bunkers 15s. 3d., export 14s. 6d.; unwashed trebles, export 17s. to 17s. 6d.; unwashed doubles, export 15s. 6d.; rough slack, bunkers 13s. 6d., export 12s.; coking smalls, export 12s.

Derbyshire and Nottinghamshire—Top hards, bunkers 18s. 9d. to 19s. 3d., export 17s. 6d. to 18s. 3d.; cobbles, bunkers 18s. 9d., export 16s. 6d. to 17s. 6d.; washed trebles, export 17s. to 17s. 6d.; washed doubles, export 16s. 6d. to 16s. 9d.; washed singles, export 16s. to 16s. 6d.; washed smalls, bunkers 16s., export 14s. 6d.; unwashed doubles, export 16s. to 16s. 6d.; rough slack, bunkers 14s. 3d. to 14s. 9d., export 12s. 6d.

Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, bunkers 17s. to 18s., export 16s. 6d. to 17s.; gas coke, export 21s. to 23s.; furnace coke, export 22s. to 23s.; washed steam (Goole, West Yorkshire), bunkers 17s. 9d.; (Hull, West Yorkshire), bunkers 18s.; (Hull, South Yorkshire), bunkers 18s. 3d., export 17s. 6d.

MIDLANDS.

There is a slow re-awakening of interest in the market. Since the pits resumed work after the holiday orders for good grades of large coal for domestic use have come in well. Contraction of output elsewhere has prevented the demand for hard qualities suitable for stacking being kept pace with.

Many of the collieries which indicated an intention to limit the special summer reductions of price to June and July have been as good as their word. In Warwickshire an advance of 1s. 6d. to 2s. has been made in superior house coals. The effect is to put prices on the same basis as in the spring. Some collieries give warning that they will make a further revision of the lists before the end of August.

Cannock Chase collieries are behind with their deliveries of deep coals. The slight relaxation of restrictions on production this month will not greatly better the position. Stringency is likely to continue in that particular department which is concerned with the supply of best coal for household use. Buyers have been notified that the September advance of prices will apply to orders which it is not possible to fulfil before the expiration of the present month.

Elsewhere there has been no concerted action regarding prices; but individual collieries have made advances. The position with regard to industrial grades is unchanged. Indications are not wanting of increasing stringency in coke. Sales are being negotiated against central heating and other non-industrial requirements of the autumn and winter. Blast-furnacemen are now asked to pay 16s. 6d. to 17s. for occasional lots.

CONTRACTS OPEN.

Pipes.

The Gas Department of the County Borough of Burnley invite tenders for the supply of welded steel and cast-iron pipes and specials. [See advert. on p. 422.]

The County Borough of Rotherham invite tenders for the supply, delivery, and erection of gas and steam mains. [See advert. on p. 422.]

TRADE NOTES.

New London Service.

For the assistance of London architects, consulting engineers, and others, the Horseley Bridge and Engineering Company, Ltd., and their associated Companies—Messrs. Thomas Piggott & Co., Ltd., and Messrs. Guest, Keen, & Piggotts, Ltd.—have opened a drawing office at No. 5, Victoria Street, Westminster. Here a technical staff is employed in designing and estimating for all classes of structural steel and bridge work. The office is being run in conjunction with the Chief London Office of these Companies at No. 11, Victoria Street, and the Manager will be pleased to receive any inquiries.

Centrifugal Pumps for Small Duties.

The Société Rateau, of 28, Russell Square, W.C. 1, have published a booklet on their centrifugal pumps constructed for small duties. The pumps described have been designed and arranged for the methods of driving most frequently adopted at the present time. The working characteristics of these pumps have been arranged in the form of tables and in such a manner that, for each type of pump, the speed necessary in order to obtain the specified capacity and head, together with the power consumption, is indicated. For any particular capacity and head it will be found that, generally, one has the choice of several types of pumps, the pump to be selected being that running at the highest speed, this being almost in every case the most economical, due consideration of course being given to the method of driving and, in the case of motor-drive, to the nature of the current available. Dimensions and weights of the various types of small pumps have also been included in this booklet which will enable clients to obtain sufficient information for their own preliminary investigations.

Morpeth Gas Light Company Results.—The Directors of the Morpeth Gas Light Company, in their report for the year ended June 30, state that the gross profit for the year amounts to £3045, which, with £1413 brought forward from the previous year, gives a sum of £4459 available. The Directors recommend that this be dealt with as follows: In placing to reserve for special renewals of plant, &c., the sum of £350, and to general reserve account £100; and in paying a dividend at the rate of 6 p.c. for the year on the preference shares (*less* tax), and 7 p.c. for the year, free of tax, on the ordinary shares, which, after the deduction of the amount paid in interim dividends in February last, and writing off the sum of £300 for depreciation, leaves a balance of £1562 to be carried forward to the next account.

GAS v. ELECTRICITY AT SOUTHWICK.

Electricity Authority Pays for Fixing Gas Cookers.

At a recent meeting of the Southwick Urban Council, the Surveyor reported that trouble had arisen over the lighting of houses and flats, owing to the rivalry of the Gas Company and the Electric Lighting Authorities. The majority of the tenants agreed to have gas installed, largely in order to avoid an additional charge levied by the Gas Company for fixing the gas stove in those cases where no gas was to be used for lighting. The Electrical Engineer then informed him (the Surveyor) that the Brighton Corporation would not complete the laying of the electric cables if the majority of the tenants were going to use gas for lighting purposes.

After making careful inquiries, he was of opinion that if no extra charge for fixing the gas cooker was involved the majority of the tenants would prefer to use electric light. The use of electric light would be an advantage to the Council owing to the probable saving on re-decoration of the premises. He recommended that the cost of fixing the gas cookers, estimated at about 10s. per house, be paid by the Council in every case where electric light is adopted, thus leaving each tenant a free choice between gas and electricity for lighting.

The recommendation was carried.

The Year's Results at Carlisle.

The financial results of the Carlisle Gas Department for the year ended March 31, after providing for income-tax, interest, and repayment of loans, &c., show a net profit of £1199, as against £10,614 for the preceding twelve months. For the first quarter of the year under review the price of gas was: In the city, 3s. 6d. per 1000 c.ft.; outside the city, 4s. per 1000 c.ft.; the price for the remaining three quarters being: In the city, 3s. 3d. per 1000 c.ft.; outside the city, 3s. 9d. per 1000 c.ft. This reduction of price during the year accounts for a decrease in income from gas sold of approximately £5000. The cost price of gas during the year was 3s. 3·69d., and for 1927-28 3s. 3·29d., being an increase of 0·40d. It should be noted that the reduced price from 3s. 6d. to 3s. 3d. will operate over the full twelve months during the current year, as against nine months only during the year under review. This will account for a decrease in revenue from gas sold for the current year of approximately £1500. The amount of gas manufactured during the year was 607,734,000 c.ft., being an increase of 21,952,000 c.ft. over the previous year. The maximum and minimum deliveries of gas during 24 hours were 2,246,000 c.ft. and 975,000 c.ft. The average price paid for coal this year is 19s. 8d. per ton, as against 22s. per ton for the previous year. The quantity of coal carbonized during the year was 30,612 tons. The number of consumers, based on the number of accounts for the year, is: Ordinary meters, 5506, and slot meters, 10,759, making a total of 16,265. The number of cookers out on March 31 this year was 9811, as compared with 9020 on the same day last year—an increase of 791.

Bussey Marketing Company, Ltd., of Dorland House, Regent Street, S.W. 1, has been registered as a private Company, with a nominal capital of £10,000, as coal and coke merchants, and dealers in all residual products of the treatment of coal.

Shrewsbury Gas Company's Sports.—The third annual sports of the Shrewsbury Gas Light Company were held on Saturday, July 3, when the sports cup presented by Mr. C. M. D. Belton (President of the Gas Company's Sports Club), to be won outright by the competitor gaining the most points, was won by E. Griffiths. Mrs. Belton presented the cup and prizes, and was accorded a hearty vote of thanks.

Satisfactory Results at Shrewsbury.—The gross profits of the Shrewsbury Gas Light Company for the year ended June 30 amount to £10,341. After allowing for the interim dividend of 2½ p.ct. (*less* tax) paid in March last, and the interest on mortgages for the year, the balance of net profit available amounts to £13,190. The Directors recommend that a final dividend of 4¼ p.ct. (*less* tax), making 6¾ p.ct. (*less* tax) for the year, be now declared. The reserve fund now stands at £13,593, and the special purposes fund amounts to £9674. There has been an increase of over 8½ million c.ft. in the sale of gas during the year, but a further fall in receipts from residual products. The price of gas has been further reduced as from June 30 by 0·2d. per therm, equivalent to 1d. per 1000 c.ft. The number of cookers on hire at June 30 was 5224, together with 1946 fires. There were also 3445 ordinary and 5779 prepayment meters in use.

Increased Sales at Harpenden.—The ordinary general meeting of the Harpenden District Gas Company was held at Harpenden on Wednesday, Aug. 14. The Chairman (Mr. T. H. Martin), in presenting the Directors' report and statement of accounts for the year ended June 30, mentioned that the expenditure in revenue account was slightly less than the previous year. On the other side of the account, however, there had been a decrease in the amount received for gas, due to the reduction in the price made in September, 1928. The receipts from tar were less also owing to the drop in prices, but it was gratifying to note that there was a good demand for coke; and that item showed an increase. A dividend at the rate of 8 p.ct. on ordinary stock (6 p.ct. standard), *less* income-tax and subject to the interim dividend already paid as recommended, was declared. There have been further extensions and replacements of mains; 75 additional ordinary and 90 prepayment consumers have been connected-up during the year; and 180 gas cooking stoves, 77 geysers, 118 gas coppers, and other apparatus have been fitted in the district. Sales of gas as compared with the corresponding period of last year showed an increase of nearly 3 million c.ft.

National Federation of Gas Consumers, Ltd., has been registered as a public Company, limited by guarantee.

Bussey Construction Company, Ltd., of Dorland House, Regent Street, S.W. 1, has been registered as a private Company, with a nominal capital of £10,000, to construct apparatus for treating coal.

South Shields Gas Company.—Dividend warrants for the half-year ended June 30, as follows, and payable on Aug. 15, were posted on Aug. 14: Consolidated stock, 4¼ p.ct.; new stock, 4¼ p.ct.; ordinary stock, 2⅛ p.ct., all *less* income-tax.

The Half-Year's Results at Fleetwood.—The half-yearly report of the Fleetwood Gas Company shows a disposable profit of £1972. The Directors recommend a dividend of 7 p.ct. per annum on ordinary stock, and 7⅛ p.ct. on the preference shares, *less* tax.

Europe's Largest Waterless Holder.—What is believed to be Europe's largest waterless gasholder is in process of construction at Oberhausen, on the Ruhr River. It is for the Gutehoffnungshutte Foundry. The total height will be 380 ft., and the complete capacity something over 12 million c.ft.

Price Reduction at Gloucester.—At a meeting of the Directors of the Gloucester Gas Light Company, an interim dividend of 5 p.ct. per annum (*less* income-tax) was declared upon the consolidated ordinary stock of the Company for the half-year ended June 30 last. The Directors also decided to reduce the price of gas to all consumers by 0·645d. per therm—equal to 3d. per 1000 c.ft.—to take effect after the reading of the meters for the current September quarter.

Manchester's Popular Proposals.—An interesting movement has been set on foot by the Manchester Gas Committee with a view to securing greater public support for its campaign to increase the sale of gas. The Committee has decided to recommend at the next meeting of the City Council that deposits by consumers for gas fires and cookers shall be halved, and the terms in hire-purchase agreements covering a period of five years reduced by about 5 p.ct. Another proposal is that if a gas fire or cooker is purchased after a period of simple hire, the amount already paid will be deducted from the purchase price after allowing for a small interest on capital. In these cases maintenance and supervision will be carried on for a nominal charge.

Welsh Patent Fuel Combine.—There has just been registered a company with the title of British Briquettes, Ltd., which has been formed to carry into effect a scheme for the amalgamation of the briquette and patent fuel industry in South Wales and Monmouthshire. The new Company will acquire the whole, or part, of the undertakings of the Crown Preserved Coal Company, Ltd., the Rose Patent Fuel Company, Ltd., the Graigola Merthyr Company, Ltd., the Pacific Fuel Company, Ltd., the Star Patent Fuel Company, Ltd., Gueret Llewellyn and Merrett, Ltd., and the Arrow Fuel Company, Ltd., and all the issued shares in the Abertillery Pitch and Benzole Company, Ltd. The capital of the amalgamated concern will be £2,000,000 in £1 shares, one-half of which will be in preference shares and one-half in ordinary.

Gasholder Over Old Lead Mine.—There was an unusual incident at Matlock Bath on Saturday, July 20, when the presence of the Fire Brigade at the Matlock Bath Gas-Works gave the impression that a blaze was in progress, and crowds of people congregated to watch operations. It was soon found that there was no need for alarm, as the Fire Brigade were engaged in cleansing the interior of the small gasholder at the works. It seems that the gasholder was built over an old lead mine shaft, and the crust over the top of this gave way, allowing all the water to flow down the shaft. This rendered the holder useless for the time being. The Gas-Works Manager, Mr. H. Maskrey, made an inspection, but the fumes down below were so strong that little could be done until the interior had been purified. This task the Fire Brigade satisfactorily accomplished. The Matlock Council have decided to engage the services of Messrs. R. & J. Dempster, Ltd., to examine the defective holder and report on the steps necessary for its repair.

Satisfactory Results at Perth.—At a recent meeting of the Perth Town Council, ex-Bailie Stewart, Convener, in submitting the accounts of the Gas Department, said the revenue during the past year from the sale of gas was £84,192, which exceeded the estimates by £3700. The total expenditure was £58,809, against the estimate of £59,580, thus leaving a balance of £25,382 to be carried to net revenue to meet loan charges. With the surplus from the previous year—the sum transferred from the revenue account—there was still a surplus of £6614. The profit on the year's working was about £800. In submitting the estimates, ex-Bailie Stewart said it was proposed to reduce the price of gas by 2d. per 1000 c.ft. A larger reduction had been pressed for, but, having additional expenditure to meet for coal and increased rates and taxes, &c., it was thought that no larger reduction could be made if the accounts were to balance at the end of the year. He added that an effort was now being made to stabilize the gas charges. The gas accounts and estimates were approved.

The Clowne Rural District Council have accepted the tender of the Whitwell Gas Company for lighting and extinguishing street lamps during the coming season at a cost of £2 9s. 4d. per lamp.

Following a leakage of gas in New Bridge Street, London, E.C., on Aug. 19, from, it is believed, one of the mains, a police cordon was drawn round the area, while shops were shut and traffic was held up. More than 100 workmen were rushed to the spot, and with the aid of gas masks a search for the defective main was begun. Precautions were taken, and passers-by were forbidden to smoke near the danger-zone. Workmen were stil busy in the evening opening-up the street with pneumatic drills.

STOCK AND SHARE LIST.

[For Stock Market Report, see earlier pages.]

Issue.	Share.	When ex-Dividend.	Dividends, Prev. Hf.Yr	Dividends, Last Hf. Yr.	NAME.	Quotations. Aug. 16.	Rise or Fall on Week.	Transactions Lowest and Highest Prices.
£			%p.a	% p.a.				
171,978	Stk.	Aug. 15	5	5	Aldershot 5 p.c. max. C.	70—75*	..	..
412,992	,,	,,	4	4	Do. 4 p.c. Pref.	73—76*	..	..
1,581,848	,,	Apl. 11	7½	7½	Alliance & Dublin Ord.	96—99	..	..
874,000	,,	July 11	4	4	Do. 4 p.c. Deb.	62—65	..	..
522,655	,,	Mar. 7	7	7	Barnet Ord. 7 p.c.	114—118	–½	114½
300,000	1	May 9	1/4½	1/4½	Bombay, Ltd.	18/6—20/6	–/6	..
172,500	10	Mar. 7	8½	9	Bournemouth 5 p.c.	13—13½	..	13½—13½
600,050	10	,,	7	7	Do. B 7 p.c.	12½—12½	..	..
439,150	10	,,	6	6	Do. Pref. 6 p.c.	10½—11½	..	11—11½
80,000	Stk.	July 11	3	3	Do. 3 p.c. Deb.	54—57	..	55
163,025	,,	,,	4	4	Do. 4 p.c. Deb.	72—75	..	74½
857,900	,,	Mar. 21	7½	7½	Brighton & Hove 6 p.c. Con.	113—116	..	..
371,880	,,	,,	6½	6½	Do. 5 p.c. Con.	100—103	..	..
1,227,500	,,	July 25	6	6	Bristol 5 p.c. max.	88—89a	+½	..
855,000	,,	Apl. 11	6	7½	British Ord.	117—120	..	..
100,000	,,	June 27	7	7	Do. 7 p.c. Pref.	112—117	..	..
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	71—74	..	..
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb.	94—97	..	96½—96½
100,000	10	May 30	6	8	Cape Town, Ltd.	9—10	..	9½
100,000	10	Apl. 24	4½	4½	Do. 4½ p.c. Pref.	6½—7½	..	..
150,000	Stk.	June 27	4½	4½	Do. 4½ p.c. Deb.	71—76	..	72½
686,660	,,	July 25	6	6	Cardiff Con. Ord.	95—98	..	98½—99½
227,840	,,	June 27	7½	7½	Do. 7½ p.c. Red. Deb.	99—102	..	..
187,150	,,	Aug. 15	6½	6	Chester 5 p.c. Ord.	86—91b*	–2	..
98,986	1	May 9	1/2/-	1/2/-	Colombo Ltd. Ord.	35/—37/-	..	..
24,496	1	,,	1/4½	1/4½	Do. 7 p.c. Pref.	30/—32/-	..	..
878,402	1	Apl. 11	1/9½	1/9½	Colonial Gas Assn. Ld. Ord.	24/6—26/6	..	..
187,848	1	,,	1/7½	1/7½	Do. 6 p.c. Pref.	20/6—22/6	..	..
2,073,280	Stk.	July 25	7	5	Commercial Ord.	93—96	..	94½—95
475,000	,,	June 13	3	3	Do. 3 p.c. Deb.	56—59	..	..
187,650	,,	Aug. 15	7	7	Croydon sliding scale	108—111*	–2	—
468,100	,,	,,	5	5	Do. max. div.	81—84*	–3	84½
543,270	,,	Mar. 7	7	10	Derby Con.	112—117e	..	..
55,000	,,	June 27	4	4	Do. Deb.	68—71e	..	..
389,000	,,	Mar. 7	5	5	East Hull Ord. 5 p.c.	73—75	..	..
1,009,180	10	Mar. 21	†4	†7	European, Ltd.	15—17	–1	15—16½
12,708,480	Stk.	July 25	5½	5½	Gas Light & Coke 4 p.c. Ord.	18/6—19/-f	–/1½	18/6—19/-
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	61—63	..	61½	
4,187,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	73—75	–1	73—74½
5,603,610	,,	June 13	3	3	Do. 3 p.c. Con. Deb.	56½—59½	–½	56½—57½
2,643,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	97—100	..	98½
83,500	,,	Mar. 21	7	7	Hastings & St L. 5 p.c. Conv	98—103	..	..
288,740	,,	,,	5½	5½	Do. 5½ p.c. Conv.	80—85	..	..
70,000	10	Apl. 24	†10	†10	Hongkong & China, Ltd.	14—15	..	14½—14½
218,800	Stk.	Mar. 7	5½	6	Hornsey Con. 5½ p.c.	86—89	..	..
1,975,000	,,	May 30	10	20	Imperial Continental Gas.	375—395	+10	365—388
228,150	,,	Aug. 15	8½	8½	Do. 8½ p.c. Red. Deb.	69—72*	–1	..
235,242	,,	Aug. 15	7½	8	Lea Bridge 6 p.c. Ord.	115—118*	–2	..
3,145,907	,,	Aug.15	6½	6	Liverpool 5 p.c. Ord.	93—94b*	–2	..
600,000	,,	Mar. 21	7	7	Do. 7 p.c. Red. Pref.	102—104b	..	..
146,736	,,	Feb. 21	9	8	Maidstone 5 p.c. Cap.	124—129	..	..
63,480	,,	June 27	3	3	Do. 3 p.c. Deb.	53—56	..	..
15,000	b	June 13	†8	‡10	Malta & Mediterranean	5½—6	..	..
392,000	—	Apl. 2	—	5½	Metrop't'n (of Melbourne) 5½ p.c. Red. Deb.	100—102	..	..
841,920	Stk.	May 30	†5	†9	Montevideo, Ltd.	105—106	..	..
3,081,818	,,	July 25	5	5½	Newcastle & Gateshead Con.	16/9—17/3d/	..	..
682,856	,,	,,	4	4	Do. 4 p.c. Pref.	70½—71½d	..	..
691,705	,,	June 27	3½	3½	Do. 3½ p.c. Deb.	66—69d	..	..
131,780	,,	Mar. 7	7/1/0	7/1/0	North Middlesex 6 p.c. Con.	105—110	..	..
800,000	,,	Apl. 24	9	7	Oriental, Ltd.	115—120	..	..
305,162	,,	June 27	8	8	Plym'th & Ston'house 5 p.c.	110—113	..	..
424,416	,,	Feb. 21	7½	8½	Portsm'th Con. Stk. 4p.c. Std.	113—118	..	..
241,446	,,	,,	5	5	Do. 5 p.c. max.	82—85	..	..
2,334,464	1	June 27	—	‡5	Primitiva Ord.	34/—36/-	–/6	33/9—35/3
244,500	100	June 8	4	4	Do. 4 p.c. Red. Deb.	92—95	..	94½—95
695,000	Stk.	July 25	4	4	Do. 4 p.c. Red. Deb. 1911	79—82	..	..
416,345	,,	June 27	4	4	Do. 4 p.c. Cons. Deb.	79—82	..	..
150,000	10	Mar. 21	6	6	San Paulo 6 p.c. Pref.	8½—9	..	..
1,736,968	Stk.	Mar. 21	6½	6½	Sheffield Cons.	108—110e	..	..
95,000	,,	Jan. 10	4	4	Do. 4 p.c. Deb.	74—77e	..	..
90,000	10	June 13	‡4	‡4	South African	4—6	..	..
6,609,895	Stk.	July 26	7½	5	South Met. Ord.	101—103	..	101—102½
500,000	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	106—107	..	107
1,895,445	,,	July 11	8	8	Do. 8 p.c. Deb.	57—60	..	..
734,000	,,	Mar. 7	6½	6½	Do. 6½ p.c. Red. Db.	100—102	..	..
91,500	,,	Aug. 15	8½	8½	South Shields Con.	103—104d*	–8½	..
1,543,795	,,	July 25	6½	6½	South Suburban Ord. 5 p.c.	103—106	..	104
468,837	,,	June 27	5	5	Do. 5 p.c. Deb.	95—98	..	96—97
647,740	,,	Aug. 15	5	5	South'mpton Ord. 5 p.c. max.	75—78*	–2	..
191,275	,,	June 27	4	4	Do. 4 p.c. Deb.	70—73	..	..
179,014	,,	July 25	8	8	Sutton Ord.	115—118	..	..
350,000	,,	Feb. 21	7	7	Swansea 7 p.c. Red. Pref.	100—102	..	..
200,000	,,	June 27	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
1,002,275	,,	Aug. 15	6½	6½	Tottenham District Ord.	105—108*	..	..
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	97—100*	..	..
181,955	,,	June 13	4	4	Do. 4 p.c. Deb.	74—77	..	..
336,094	,,	Mar. 7	6½	7	Uxbridge, Maidenhead, & Wycombe 5 p.c.	93—98	..	..
92,880	,,	,,	5	5	Do. 5 p.c. pref.	88—93	..	..
80,000	,,	July 11	9	9	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	144—147	..	..
355,656	,,	,,	7½	7½	Do. B 5½ p.c.	122—127	..	..
482,385	,,	,,	6.3/16	6.3/16	Do. C and New	100—105	..	..
351,000	,,	,,	7½	7½	Do. Wimbledon 5 p.c.	112—117	..	..
96,000	,,	,,	7½	7½	Do. Epsom 5 p.c.	123—128	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref.	87—93	..	..
84,416	,,	June 27	3	3	Do. 3 p.c. Deb.	54—57	..	..
284,742	,,	,,	4	4	Do. 4 p.c. Deb.	74—77	..	..
307,600	,,	,,	5	5	Do. 5 p.c. Deb.	93—96	..	..

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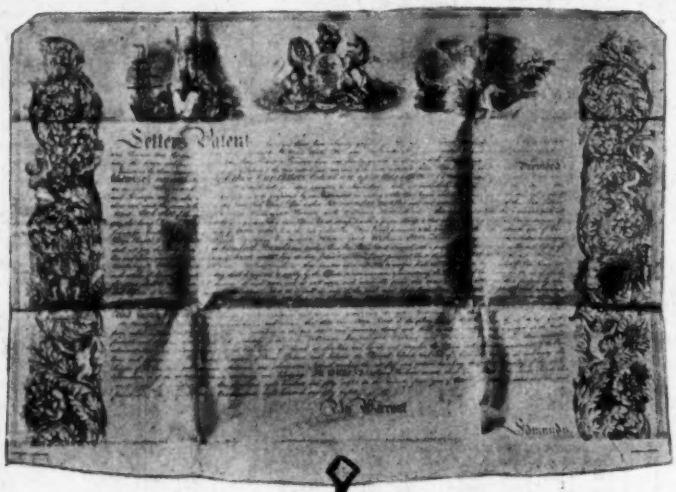

1855

Patent granted to William Cartwright Holmes, the Founder of the firm of W. C. Holmes and Company, Ltd.

1883 THE "BRUSH" WASHER first patented.

1895 THE "NEW" BRUSH WASHER introduced.

1899 "WESTERN" GAS VALVES first introduced.

1911 CONTINUOUS TAR DISTILLATION.

1914 SUPER TYPE, HORIZONTAL TUBE CONDENSERS.

1920 THE "1920" PATENT BRUSH WASHER.

1922 STAGE WASHING for COMPLETE NAPHTHALENE REMOVAL perfected.

1926 CONNERSVILLE POSITIVE "DRY" STATION METERS, Exhausters and Boosters introduced.

1927 THE "DRI-GAS" PROCESS for removal of water vapour before distribution.

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